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A RECORD OF ACHIEVEMENT

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**A Report on Activities under the
Prairie Farm Rehabilitation Act
for the Eight-year Period ended
March 31, 1943.**

Prairie farm rehabilitation administration

DEPARTMENT OF AGRICULTURE

OTTAWA - CANADA



Published by authority of the Hon. JAMES G. GARDINER, Minister of Agriculture
Ottawa, Canada

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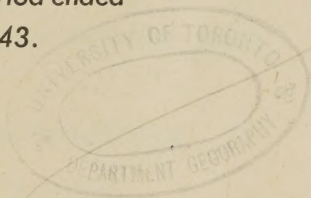
P. F. R. A.

A RECORD OF ACHIEVEMENT

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DEPARTMENT OF AGRICULTURE

OTTAWA - CANADA



Published by authority of the Hon. JAMES G. GARDINER, Minister of Agriculture
Ottawa, Canada

PRAIRIE FARM REHABILITATION

The Prairie Farm Rehabilitation Act is administered through
The Department of Agriculture, Ottawa, Canada

Minister.....Hon. JAMES G. GARDINER

Deputy Minister.....Dr. G. S. H. BARTON

Supervising P.F.R.A. Cultural Program—

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Department of Mines and Natural Resources, Winnipeg, Manitoba.

Department of Agriculture, Regina, Sask.

Department of Natural Resources, Regina, Sask.

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This report has been compiled by: Wm. Dickson, *Soil Specialist*, P.F.R.A.,
Central Experimental Farm, Ottawa.

CROP DISTRICTS IN THE PRAIRIE PROVINCES

⑤ CROP DISTRICT NUMBERS

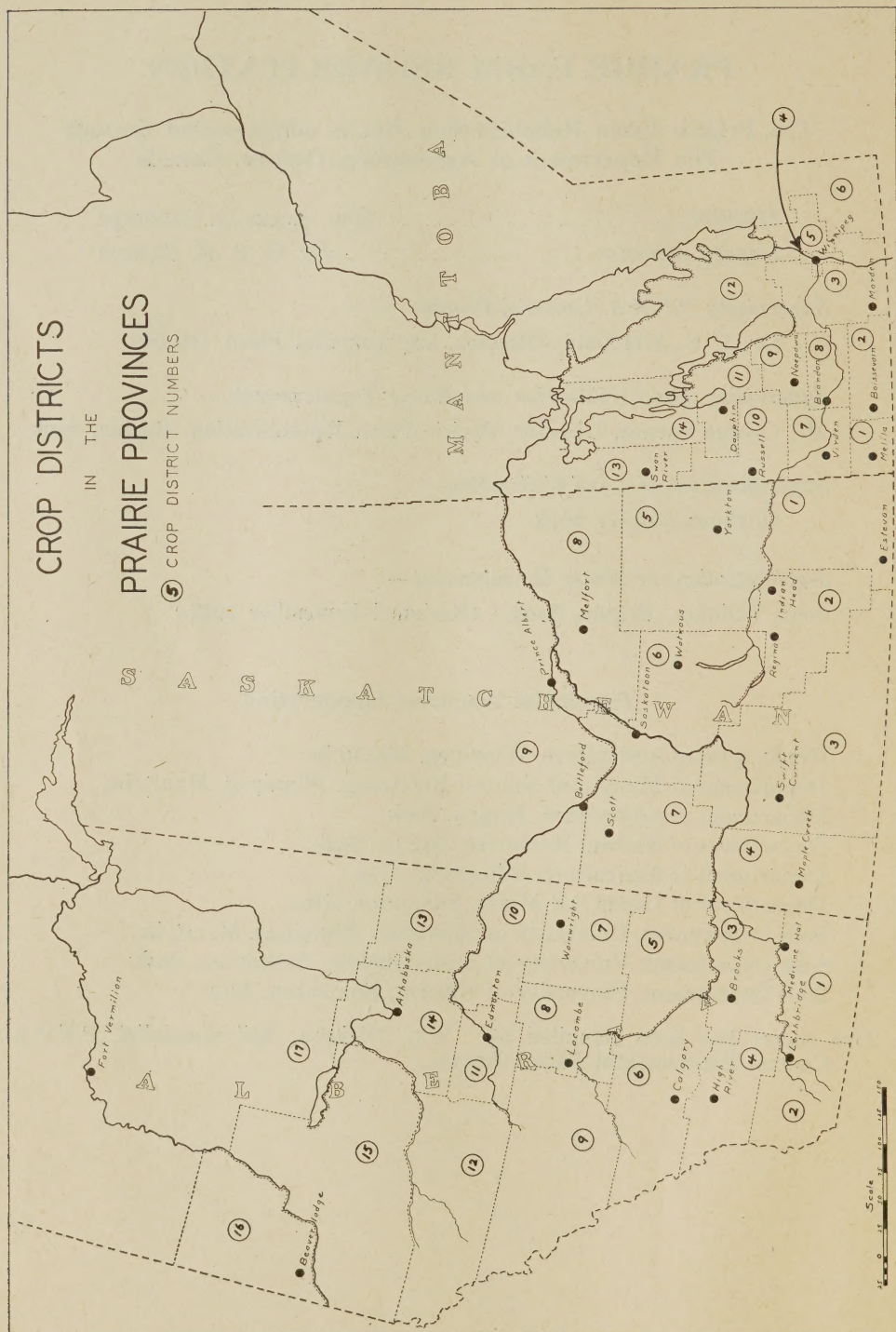


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P.F.R.A.

A RECORD OF ACHIEVEMENT

Foreword

The Prairie Farm Rehabilitation Act (P.F.R.A.) was passed by the Dominion Parliament in April, 1935. The purpose of this Act was to assist prairie farmers to combat the combination of drought and economic depression which was then pressing with unprecedented severity on prairie agriculture. This P.F.R.A. program has resulted in appreciable improvements in prairie agriculture, especially as regards the control of soil drifting, the better utilization of land, and the conservation of water for farm purposes. To describe in some detail the aims, development and achievements of the P.F.R.A. program is the object of this report.

Conditions Affecting Agriculture in the Prairie Provinces of Canada

The following brief descriptions of the physiography, climate, vegetation and soils, water resources and agriculture of the Prairie Provinces are basic to an outline of P.F.R.A. work and problems.

PHYSIOGRAPHY

The Canadian prairies occupy the south-central section of the great plain which lies between the Precambrian rock plateau surrounding Hudson Bay, and the Rocky Mountains. Northwards this plain narrows into the valley of the Mackenzie River and southwards into the "great plains" region of the United States. In Canada the true prairies, or grass covered plains, form a rough triangle, the base of which extends from southwestern Manitoba, through Saskatchewan, to southwestern Alberta, and with its apex reaching roughly to within 60 miles southeast of Edmonton, Alberta. East, north and west of this triangle the plain is wooded, the transition between grassland and woodland being gradual. In general, the plain slopes gently downwards to east and north from the Rocky Mountains, with low hill masses occurring at irregular intervals. This plain rests on undisturbed sedimentary rocks, the occasional hills representing uneroded areas of upper geological formations. The underlying bed-rock is covered for the most part with deposits of glacial drift of varying thickness, carrying in places broad lacustrine and alluvial deposits.

Most of the rivers in the Canadian prairies flow from the Rocky Mountains through deeply trenched valleys at depths of from 200 to 500 feet below the general level of the surrounding prairie. Most of the flow is to Hudson Bay, but a small area in the southwest lies in the Missouri basin. In the dry prairie region some of the smaller intermittent streams empty into lakes which have no outlet.

CLIMATE AND VEGETATION

Scanty precipitation is the principal factor controlling the distribution of native vegetation, as well as of crops, in the Prairie Provinces. The average annual precipitation ranges downward in a westerly direction from 19.8 inches

at Winnipeg, Manitoba, to 12·8 inches at Medicine Hat, Alberta. Precipitation also decreases northwards, the average annual amount received at Fort Vermilion, Alberta, being only 11·8 inches. The efficiency of rainfall in plant growth, however, is somewhat greater in the Fort Vermilion area than at Medicine Hat, because of lower evaporation arising from lower temperatures in the north. As a whole, compared with Eastern Canada, where the annual precipitation ranges from about 25 to over 40 inches, the Prairie Provinces are at best sub-humid and in some regions semi-arid. An important feature of the prairie climate is that most of the precipitation is received during the summer season.

Prairie climate is further characterized by warm summers and cold winters and by wide extremes in temperature. Mean monthly temperatures range from about zero degrees Fahrenheit in January to above 60 degrees in July. Extreme low winter temperatures of forty degrees below zero are common, while summer temperatures sometimes exceed one hundred degrees above zero. In general, mean temperatures decline from south to north. Likewise, summer frosts, occasionally experienced in the south, become more frequent towards the north.

The combined effect of precipitation on the amount of moisture available for plant growth has a profound influence on native vegetation and cropping possibilities. In the south-central section of the Prairie Provinces, where high summer temperatures reduce by evaporation the effectiveness of the relatively light rainfall, the native vegetation is largely confined to short grasses and small drought-resistant plants, and agriculture to a rather hazardous production of cereals or to cattle ranching. Outside of the "short grass" area a more favourable balance between rainfall and evaporation results in a "tall grass" vegetation, with scattered clumps of woodland. Crop production in this area is less hazardous than in the "short grass" area, but is still largely limited to cereals. The foregoing two vegetational zones constitute what is generally referred to as the prairies. Beyond these zones the influence of relatively high rainfall or of low evaporation has favoured the natural establishment of forests which extend across the northern reaches of the Prairie Provinces. Crop production in the southern fringes of the wooded areas covers a wider range of crops than in the prairies, but is subject to greater danger from frosts.

SOILS

The outstanding characteristic of prairie soils as a whole is their high inherent fertility, the limiting factor in crop production being moisture rather than plant nutrients. Prairie soils exhibit to a marked degree the influence of climate and vegetation, modified locally of course by topography and texture. In the southwestern short-grass region the chief visible characteristic is their light brown colour from which the area derives the name of "Brown Soil Zone". This colour is due to a relatively low content of organic matter, the result of sparse vegetation and rapid oxidation. These soils show only slight evidence of leaching, salts being accumulated in "lime" and "gypsum" layers near the surface, while surface accumulations or "alkali" spots are of frequent occurrence in some districts. The region occupied by the Brown soils forms a rough triangle of about 34 million acres in area, with its base extending along the International Boundary, from Estevan in southeastern Saskatchewan to near the longitude of Lethbridge in southwestern Alberta, and with its apex near the town of Coronation in Alberta.

Outside of the Brown soil region in a zone ranging in width from 40 to 80 miles, and covering some 30 million acres, occur soils of a dark brown colour which reflect the influence of more favourable climatic conditions. These soils developed under a heavier grass cover than the brown soils, possess a correspondingly higher content of organic matter and have been subjected to a greater degree of leaching. Much of the best wheat land in western Canada is found in the dark brown zone.

East, north and west of the dark brown soil zone, and running diagonally across Saskatchewan from southern Manitoba to the Edmonton district of Alberta, thence southward along the eastern base of the Rockies, occurs a belt of black soils, corresponding roughly to tall-grass parkland. These soils, developed under sub-humid conditions, are characterized by high humus content, high fertility and greater evidence of leaching than in the brown soils. Constituting the most fertile farmland, though not necessarily the best wheat land, in western Canada, the black soils cover an area of about 42.5 million acres.

Beyond the black zone the soils grade off through a transitional zone to the grey wooded soils of the northern forest, which differ markedly from the grassland soils of the prairies. The grey wooded soils have been subject to relatively heavy leaching with the resultant loss of plant food. In some districts, notably central Alberta, the low fertility of the grey wooded soils can be satisfactorily remedied by fertilizer treatments, growing legumes, and the application of sulphur.

Throughout a large part of Manitoba, chiefly in the section west and north-west of Lake Manitoba, the effect of leaching in the wooded soils has been modified by the presence of a relatively high percentage of lime. Both the grey wooded soils and the "high lime" soils, however, lie outside of the area coming under the provisions of the P.F.R.A.

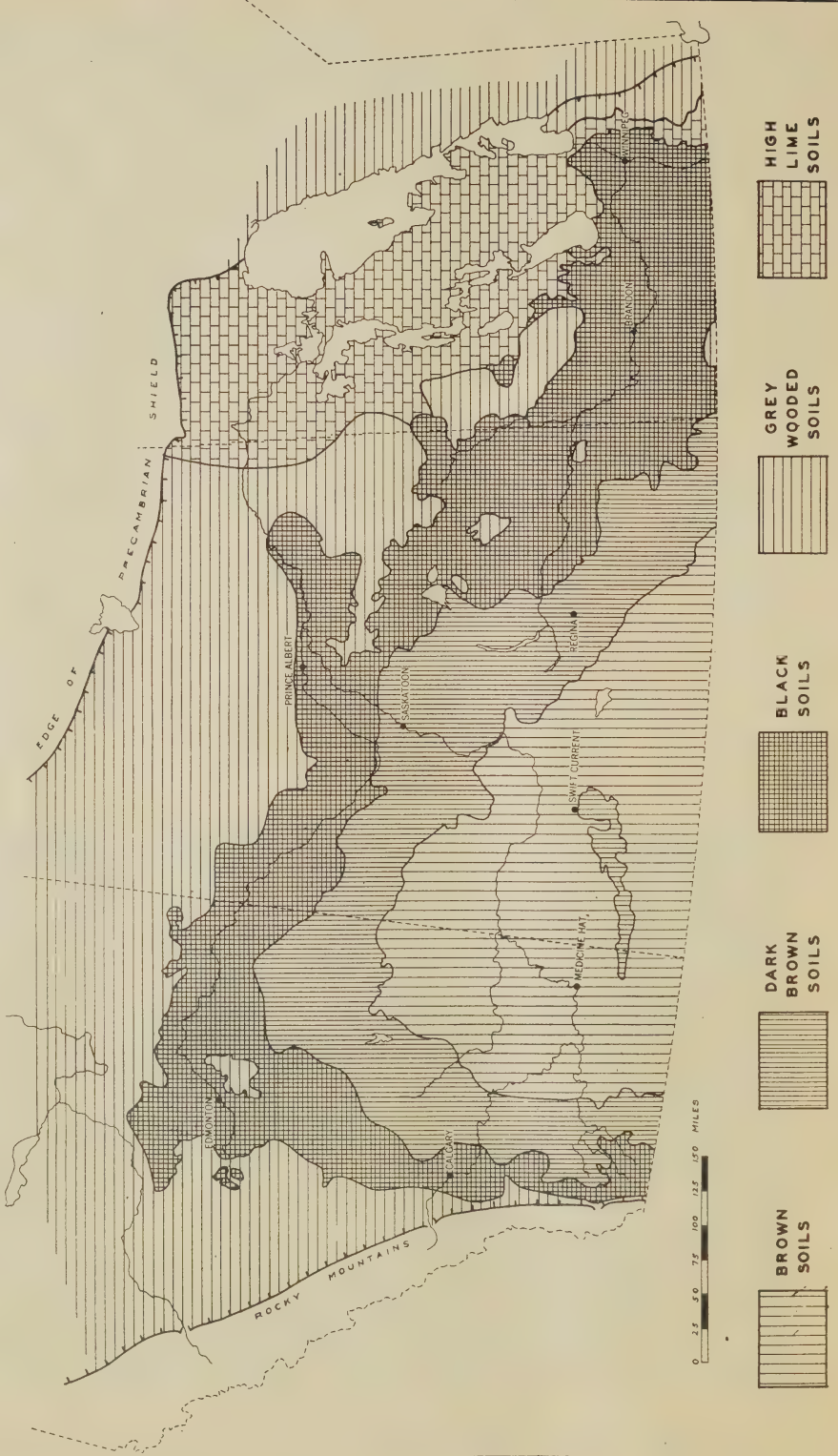
The location of the various soil zones described above is shown on the "Generalized Soil Map of the Prairie Provinces", shown on page 10.

Throughout the Prairie Provinces the major soil characteristics are modified by differences in texture. This is particularly the case with heavy clay soils which form such highly fertile areas as the Red River Plains, the Regina Plains and the Drumheller clays. At the other extreme, dune sands present areas entirely unsuited for farming in several districts, notably near Brandon, Manitoba, and in the Great Sand Hills of Saskatchewan. The bulk of prairie soils are intermediate in texture.



FIG. 1.—Strip farming was practised in Alberta as early as 1920 as an aid in controlling soil drifting. Under P.F.R.A. strip farming has been extended to extensive areas in southern Alberta and western Saskatchewan.

GENERALIZED SOIL MAP OF THE PRAIRIE PROVINCES



WATER RESOURCES

Considerable difficulty is encountered on the Canadian prairies in securing water supplies for agricultural and other purposes. This condition arises primarily from the dry climate. Rainfall generally is insufficient to maintain a high water-table in the soil which might be tapped through shallow wells. Many of the streams which originate within the prairie region are of the intermittent type which flow only during the spring thaw or after very heavy rains. Reasonably reliable supplies of water are obtainable in the rivers which flow from the Rocky Mountains, but these rivers are separated throughout most of the prairie by quite wide intervals, and flow in deeply trenched valleys which present an effective barrier to their utilization. Over the major portion of the prairie region it is possible to travel for many tens of miles without encountering a year-round natural supply of water.

To secure reliable supplies of water under the foregoing conditions for agricultural purposes, it has been necessary for many farmers to incur the expense of sinking drilled wells, of transporting water from distant sources, or of creating artificial reservoirs by damming intermittent streams or excavating dugouts. The disadvantages of these methods are obvious and in many cases have been sufficient to retard agricultural development, particularly as regards the raising of live stock.

Three of the four main physical factors in successful irrigation, dry climate, fertile soil and nearly level topography, are to be found in numerous districts, both large and small, throughout the Canadian prairies. The fourth important factor of adequate and convenient water supply, however, is limited by nature to relatively few districts. In southern Alberta topographic conditions render it possible to divert water from the rapidly descending rivers which rise in the Rockies and to conduct this water by gravity through canals to areas suitable for irrigation. This condition accounts for the existing development of irrigation projects in southern Alberta. Further east the trenching of the rivers makes it impossible to divert water from the large rivers by gravity, the level of the water in the river valleys being from 200 to 500 feet below the level of the surrounding prairie. Irrigation under the latter condition depends on storage of local surface run-off.

AGRICULTURE

The outstanding characteristic of prairie agriculture is the predominance of cereal culture, 38,320,952 acres or over 94 per cent of the 40,194,581 acres under field crops in 1936 being under cereal crops, mostly wheat, oats and barley. Wheat is by far the most important single crop. If to the 24,837,824 acres devoted to this crop in 1936 there is added the 16,854,590 acres under fallow, since most of the summer-fallow acreage is used for wheat production, the total area devoted to wheat may, with reasonable certainty, be set at over 40 million acres, or nearly 70 per cent of the 60,849,957 acres of cultivated land in the Prairie Provinces.

The production of cereal crops has been imposed on prairie agriculture by the dry climate, which limits plant growth to relatively drought-resistant grasses, grains and similar crops. The predominance of wheat has arisen from the excellent quality of this crop when grown on the prairies, and from the existence in normal times of a large domestic and export demand for prairie wheat.

One striking characteristic of agriculture on the Canadian prairies is the large percentage of the cultivated land which is under summer-fallow each year. Of the total acreage of cultivated land in the Prairie Provinces during 1936, slightly under one-third was under summer-fallow. The objects of summer-fallowing are to conserve soil moisture and to control weeds. Actually,

moisture conservation is effected by preventing all growth, including that of weeds, during one season, in order to promote some accumulation of rainfall moisture in the soil to supplement rainfall for crop growth in the succeeding season. In the drier prairie areas the moisture-conserving property of the summer-fallow is of prime importance. In the more humid prairie areas, however, the difficulty in controlling weeds under almost continuous cereal culture makes summer-fallow more necessary for weed control than for moisture conservation.

Much of the land on the prairies is suitable for large-scale farming. Accordingly, the use of large implements and large power units has been widely adopted. Large teams, tractors, multiple plough and tillage units, combine harvesters and large threshing outfits, are familiar objects in Western Canada.

In districts where the land is submarginal for crop production, live stock ranching forms the principal agricultural enterprise. A considerable percentage of the 3,900,000 head of cattle and 1,300,000 sheep in the Prairie Provinces in 1936, were maintained on some 34,000,000 acres of grazing land, with some supplementary feeding of grain and forage crops.

Agricultural practice in the prairies is considerably influenced by local conditions of soil and climate. The percentage of wheat to total crop production ranges from 79 per cent in the brown soil zone, through 69 per cent in the dark brown zone, to only 49 per cent in the black soils. Correspondingly, the percentage of natural pasture to total occupied land is 47 per cent in the brown soil zone, 27 per cent in the dark brown zone and 20 per cent on the black soils. Thus there is a tendency for one-crop culture or ranching to be followed in the drier areas and for mixed farming on the outer zone of the prairies.

In the aggregate, farming in the Prairie Provinces constitutes an impressive enterprise. The 300,000 farms in this region represent a capital investment of approximately two billion dollars, while the average annual value of agricultural produce has been in the neighbourhood of five hundred million dollars. Roughly, two-fifths of the gross value of agricultural production and one-sixth of the gross value of all primary production in Canada are derived from the Prairie Provinces. It is obvious, therefore, that any major change in agricultural conditions in the prairies must have corresponding repercussions throughout the Dominion as a whole.

From a historical viewpoint, agriculture on the Canadian prairies is of quite recent development. In 1856 there were only 8,806 acres of land under cultivation in the entire area now occupied by the three Prairie Provinces. By 1881, ten years after the control of the prairies had been transferred from the Hudson's Bay Company to the Dominion of Canada, there were 279,000 acres of land under cultivation, mostly in Manitoba. Some increase in agricultural development followed the completion of the main line of the Canadian Pacific Railway in 1885, the total acreage under cultivation amounting by 1901 to 5,593,000 acres. Thereafter the rate of prairie settlement was accelerated, 22,970,000 acres in the three Prairie Provinces being under cultivation by 1911, and 60,850,000 by 1936. Population in the meantime had increased from 12,228 in 1871 to 2,414,891 in 1936. Thus it will be observed that the bulk of prairie settlement has taken place within the present century.

The rapid development of prairie settlement has been accompanied by the evolution of suitable methods of farming for which, at the outset, no precedents were available. In this it was inevitable that mistakes would be made, that it would take many years for the full range of conditions to be experienced, and that periodical adjustments would become necessary in the economy and practice of prairie farming. Indeed, the history of prairie agriculture is too brief to lead to the assumption that all of the physical, let alone economic, hazards are known or fully appreciated. Readiness to adjust practice to meet changing conditions is a prime necessity in prairie farming. An example of

this need for preparedness to make adjustments is found in the great agricultural crisis arising from an unprecedented combination of depression and drought, which was experienced in the Prairie Provinces through most of the third decade of the present century.

Depression and Drought in the Prairie Provinces

In the year 1930 agriculture on the Canadian prairies, hitherto reasonably prosperous, entered a period of combined economic depression and severe droughts. The agricultural crisis which resulted has exerted a profound influence on the lives and fortunes of prairie farmers.

The depression, inaugurated by the memorable stock market "crash" of 1929, and which was world wide in scope, bore with particular severity on prairie farmers. There were several reasons for this condition. Prairie agriculture, as a whole, was dependent on the export grain trade for much of its revenue. Contemporary with the depression, however, the export grain trade had encountered obstacles in marketing wheat abroad due to increased foreign production and to newly erected tariff barriers. Restricted markets in turn resulted in reductions in the price of wheat and other cereals. For the nine-year period from 1930 to 1938, inclusive, the average farm price of wheat in the Prairie Provinces was only 55 cents per bushel as compared with 92 cents for the preceding nine years. This represented a drop of 49 per cent, and similar reductions prevailed with regard to other crops. For the year 1932, in the trough of the depression, the average farm price of wheat in the Prairie Provinces was 34 cents per bushel, and some farmers received less than 20 cents per bushel. In this connection it must be remembered that prices of farm produce fell to much lower levels than the prices of many of the commodities which farmers had to buy. On the basis of farm prices alone, therefore, prairie farmers experienced a severe setback. In the meantime, farm indebtedness, normally greater on western than on eastern farms, remained at pre-depression levels while interest due on borrowings accumulated.



FIG. 2.—This is an extreme case of drifting where the soil is very light. The remedy used here was to seed back to grass.



FIG. 3.—Effective methods for seeding badly-drifted areas to grass have been developed under P.F.R.A. Here a crop of rye was used to provide cover before the grass was seeded.

The foregoing adverse circumstances were aggravated by the fact that the prairie farms had relatively little production of food for home consumption. In this respect the prairie farm was at a distinct disadvantage as compared with the eastern farm, where some degree of subsistence farming is customary.

To the economic misfortunes of the prairie farmer, there were added the devastating effects of prolonged drought. During the period 1930 to 1937, inclusive, there was experienced in the south-central region of the Prairie Provinces an almost unbroken succession of dry years. Over extensive areas crop failures, complete or partial, were repeatedly experienced. In some districts the soil, inadequately protected by vegetation as a result of drought, drifted under the erosive effect of high winds, destroying crops and injuring land.

It has been estimated that fully one-third of the cultivated land in the open plains has been affected by soil drifting, in many districts with a permanent reduction in fertility. So severe were these conditions that popular references to the "Canadian Desert" carried an ominous import. Fortunately, as will be shown, the development of methods of minimizing the effects of drought and of controlling soil drifting, together with recent improvements in weather conditions, have led to a much brighter prospect.

To illustrate the separate and combined effects of depression and drought on prairie farm economy, some statistics of price and yield may be presented. For this purpose it is convenient to compare two periods of nine years each; the years 1921 to 1930, inclusive, just preceding the drought period, and the years 1930 to 1938, inclusive, during which drought and depression were experienced. Further, since the most severe drought was experienced in the south central region of the Prairie Provinces, and practically no drought in the eastern, northern and western regions, with an intervening transition zone, it is

desirable to divide the Prairie Provinces, as well as available statistics will permit, into a "Severe Drought Area", a "Moderate Drought Area", and a "Drought-Free Area", as follows:—

Severe-Drought Area.—Crop districts No. 1 in Manitoba; Nos. 1, 2, 3, 4, 6 and 7 in Saskatchewan; and Crop District No. 5 in Alberta. In any crop district in this area the average yields of wheat, oats and barley during the 1930-38 period was not more than 65 per cent of the corresponding yields for the 1921-29 period.

Moderate-Drought Area.—Crop Districts Nos. 2, 7, 8, and 10 in Manitoba; Nos. 8 and 9 in Saskatchewan; and Nos. 1, 2, 3, 4 and 7 in Alberta. In these crop districts drought reduced the yield of wheat during the 1930-38 period to between 65 and 85 per cent of the 1921-29 period.

Drought-Free Area.—Includes the remainder of the Prairie Provinces. The location of Crop Districts in the Prairie Provinces is shown on the map on page 4. In the following table are presented figures of average yield, average farm price and average return per acre for wheat, oats and barley in each of the regions outlined above, and for each of the selected nine-year periods. This table, while somewhat cumbersome, is well worth study as showing clearly the separate and combined effects of drought and depression on prairie farm income.

*¹EFFECT ON FARM INCOME OF DEPRESSION AND DROUGHT PRAIRIE
PROVINCES OF CANADA

TABLE 1

AVERAGE YIELD PER ACRE, AVERAGE FARM PRICE, AND AVERAGE RETURN PER ACRE OF WHEAT, OATS AND
BARLEY FOR THE PERIODS 1921 TO 1929, INCLUSIVE, AND 1930 TO 1938, INCLUSIVE. COMPUTED FROM
DATA PUBLISHED BY THE DOMINION BUREAU OF STATISTICS

| | Severe Drought Area | | Moderate Drought Area | | Drought-Free Area | | Three Prairie Provinces | |
|-------------------------------|------------------------|--------------------|--------------------------|--------------------|----------------------|--------------------|----------------------------|--------------------|
| | 1921 to 1929 | 1930 to 1938 | 1921 to 1929 | 1930 to 1938 | 1921 to 1929 | 1930 to 1938 | 1921 to 1929 | 1930 to 1938 |
| <i>Wheat—</i> | | | | | | | | |
| Ave. farm price per bu.....\$ | .91 | .53 | .96 | .55 | .88 | .56 | .92 | .55 |
| Ave. yield per acre bu..... | 16.5 | 7.6 | 17.0 | 14.1 | 19.1 | 17.3 | 17.2 | 11.7 |
| Ave. return per ac. *2.....\$ | 14.98 | 4.03 | 16.38 | 7.75 | 16.88 | 9.70 | 15.75 | 6.42 |
| <i>Oats—</i> | | | | | | | | |
| Ave. farm price per bu.....\$ | .34 | .18 | .36 | .20 | .36 | .21 | .35 | .20 |
| Ave. yield per acre bu..... | 30.2 | 13.6 | 33.1 | 24.7 | 32.6 | 30.1 | 31.7 | 22.8 |
| Ave. return per ac. *2.....\$ | 10.32 | 2.47 | 12.01 | 5.05 | 11.64 | 6.40 | 11.18 | 4.65 |
| <i>Barley—</i> | | | | | | | | |
| Ave. farm price per bu.....\$ | .49 | .24 | .51 | .28 | .49 | .31 | .50 | .29 |
| Ave. yield per acre bu..... | 23.2 | 11.0 | 25.6 | 18.4 | 24.4 | 22.2 | 24.4 | 18.4 |
| Ave. return per ac. *2.....\$ | 11.36 | 2.66 | 13.14 | 5.25 | 12.03 | 6.84 | 12.18 | 5.35 |

*¹ See also Appendix I on page 68.

*² The average return per acre in the above table is not exactly the product of the yield and price shown because of rounding of decimal figures.

A brief study of the above table will show that, while the depression alone brought serious reduction in income for all farmers in the Prairie Provinces, for those located in the severe drought area, the added effects of drought were sufficient to render economic farming impossible. In the drought-free area the average value per acre of wheat was reduced from \$16.88 in the 1921-29 period

to \$9.70 in the 1930-38 period. The corresponding reduction for oats was from \$11.64 to \$6.40 per acre, and for barley \$12.03 to \$6.84 per acre. Thus the return per acre for each of these crops in the 1930-38 period was roughly only 60 per cent of the corresponding values in the 1921-29 period. This reduction could be attributed almost entirely to the effects of economic depression. Under such conditions cereal production was still an economic though not an attractive possibility.

In effect, the average returns from cereal production in the severe drought area during the 1930-38 period, being generally less than a reasonable cost of production, were such as to threaten widespread bankruptcy among farmers in the severe-drought area.

In the moderate-drought area, where conditions in the 1930-38 period were intermediate as between the severe-drought area and the drought-free area, the returns from cereal production were probably on a bare subsistence level.

The full cost of depression and drought to the Prairie Provinces is difficult to estimate. In the following table, however, some estimates are presented showing the actual difference in the total acreage of wheat, oats and barley, and in the total value of these crops produced over the nine years, 1921-29, inclusive, and the succeeding nine years, 1930-38, inclusive. An estimate is also presented of the possible value of these crops for the latter period on the assumption that the yields and prices of the 1921-29 period had prevailed during the 1930-38 period.

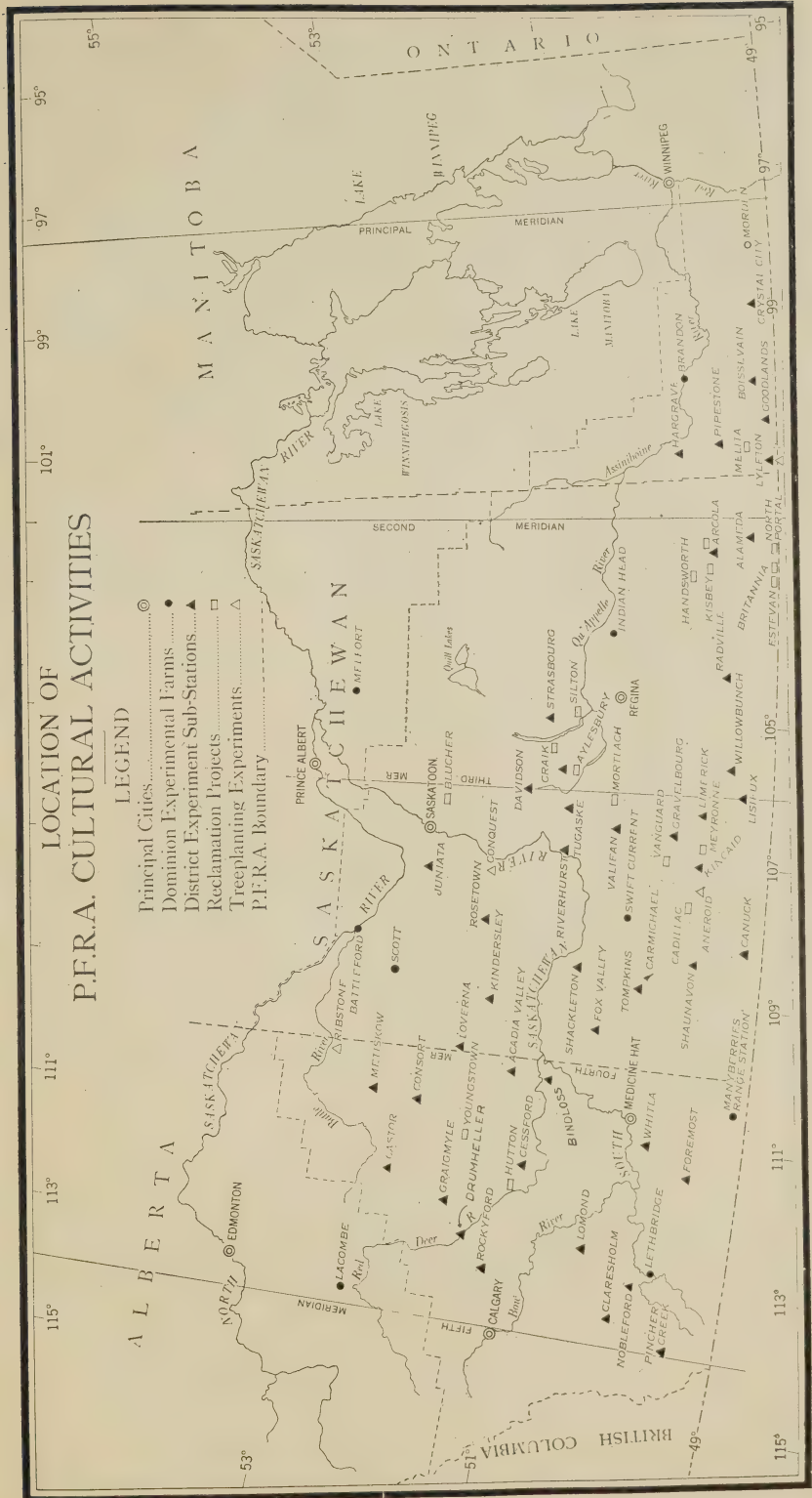
*EFFECT OF DEPRESSION AND DROUGHT ON THE TOTAL VALUE OF PRODUCTION OF WHEATS, OATS AND BARLEY, PRAIRIE PROVINCES OF CANADA

TABLE 2
ESTIMATES FROM DATA PUBLISHED BY THE DOMINION BUREAU OF STATISTICS

| | 1921-29 Period | 1930-38 Period | Difference Between 1921-29 and 1930-38 |
|--|------------------------|------------------------|---|
| Average annual area under wheat, oats and barley— | acres | acres | acres |
| Severe-drought area..... | 15,945,000 | 16,057,000 | Increase of 112,000 |
| Moderate-drought area..... | 8,447,000 | 9,524,000 | Increase of 1,077,000 |
| Drought-free area..... | 9,080,000 | 11,269,000 | Increase of 2,189,000 |
| Prairie Provinces..... | 33,472,000 | 36,850,000 | Increase of 3,378,000 |
| Total value of wheat, oats and barley produced— | Millions of Dollars | Millions of Dollars | Millions of Dollars |
| Severe-drought area..... | 1974 | 528 | Reduction of 1446 |
| Moderate-drought area..... | 1140 | 590 | Reduction of 550 |
| Drought-free area..... | 1180 | 840 | Reduction of 340 |
| Prairie Provinces..... | 4294 | 1958 | Reduction of 2336 |
| Total value of production assuming 1921-29 yields and prices— | | | |
| Prairie Provinces..... | 4294 | 4777 | Increase of 483 |

* See also Appendix I on page 68.

It will be observed in the above table that the average annual acreage in the Prairie Provinces under wheat, oats and barley was greater during the 1930-38 period than in the 1921-29 period by some 3,378,000 acres. In spite of this increase in acreage, however, the total value to prairie farmers of these crops for the entire 1930-38 period was only some 1,958 million dollars. If the



1921-29 prices and yields had prevailed throughout the 1930-38 period, the total value of production of wheat, oats and barley would have been 4,777 million dollars, an increase due to increased acreage over the preceding period of 483 million dollars. On the basis of these figures, therefore, it is reasonable to assume that the total loss suffered by prairie farmers in revenue from wheat, oats and barley during the depression and drought period of 1930-38 was between 2,336 million dollars and 2,819 (2,336 + 483) million dollars. Roughly, one-half of this loss was suffered by farmers in the severe drought area.

The drastic reduction in farm income just described resulted in a corresponding curtailment in the revenues of municipal and provincial governments through the inability of many farmers to pay taxes. To enable these governments to maintain essential services, to cope with heavy relief charges, and to effect necessary adjustments in prairie agricultural economy, the Dominion Government, from time to time, introduced various measures. One such measure, to assist prairie farmers to adjust and improve their farm practices, with a view to continued operations under existing conditions of drought and depression, was initiated by the Prairie Farm Rehabilitation Act.

The Prairie Farm Rehabilitation Program

The Prairie Farm Rehabilitation Program, designed to help farmers to solve as many as possible of their own problems, has been developed with three main objectives.

1. *Cultural*.—To secure the adoption by farmers of such tillage and cropping practices as will enable them to farm successfully under a wide and fluctuating range of physical and economic hazards.

2. *Land Utilization*.—To divert crop production from poor land and to use such land for grazing.

3. *Water Development*.—To make better use for agriculture than formerly of the limited water resources of the prairies.

Each of these objectives has become the responsibility of branches of the Dominion Department of Agriculture. The Cultural program is conducted by the Experimental Farm Service. For Land Utilization and Water Development a special Prairie Farm Rehabilitation Administration has been set up with headquarters in Regina, Saskatchewan. Under the terms of the Act the administration of the program is vested in the Dominion Minister of Agriculture, assisted by a number of Advisory Committees.

The nature and progress of the various lines of work carried on under the P.F.R.A. are described in the following sections covering the cultural, land utilization and water development programs.

The P.F.R.A. Cultural Program

The location of the various places referred to in the following description of the P.F.R.A. Cultural Program is shown on the map on page 17.

In so far as the P.F.R.A. program affects the technique of crop and live stock production on the prairies, it constitutes a special phase of the work of the Dominion Experimental Farms. A brief historical reference to these Farms is necessary to a comprehensive outline of the P.F.R.A. program.

THE DOMINION EXPERIMENTAL FARMS

The Dominion Experimental Farm System was established in 1886, and two of the five original Farms were located in the prairie region, one at Brandon, Manitoba, and one at Indian Head, Saskatchewan (then in the Northwest

Territories). As settlement spread during succeeding years, additional farms, designated Dominion Experimental Stations, were located at Lethbridge, Alberta (1906), Lacombe, Alberta (1907), Rosthern, Saskatchewan (1911), Scott, Saskatchewan (1911), Morden, Manitoba (1914), Swift Current, Saskatchewan (1921) and Melfort, Saskatchewan (1935). In 1927 a Range Experimental Station, for investigational work on cattle ranching problems, was established at Manyberries, Alberta. The function of these Farms and Stations is to conduct experimental work on such agricultural problems as are encountered in their respective districts, the results of which are made available to the farming public.

In view of the fact that the majority of the Experimental Farms on the prairies have been in operation since the beginning of agricultural settlement in their respective districts, and can draw, at need, on extensive scientific resources, they are in a position to provide valuable advisory services to prairie farmers.

In various ways the Experimental Farms have rendered useful service to prairie agriculture. The introduction and improvement in methods of summer-fallowing, whereby the disadvantages to crop production of the dry prairie climate have been in some measure overcome, is one example. Another contribution was the development on the Central Farm at Ottawa of Marquis wheat, the early maturing habit of which extended the area suitable for wheat production. More recently, to the solution of the serious wheat stem rust problem of Western Canada, the Farms have contributed such rust-resistant wheats as Renown and Regent. In addition to these and similar major results of research work, the Farms have maintained contacts with thousands of farmers, providing advice and demonstrations on the array of practical topics which, in the aggregate, make up the art of farming.

THE ROLE OF THE EXPERIMENTAL FARMS IN THE P.F.R.A. PROGRAM

With the initiation of the P.F.R.A. program in 1935 the investigational and demonstrational work of the Experimental Farms was expanded throughout the drought area, special attention being given to the problems of soil drifting control, land reclamation and farm home improvement. In this, the existing Experimental Farms served as centres of rehabilitation. Expansion in the services of these Farms has been accomplished through the establishment of various agencies. For the demonstration and trial of farm practices specially applicable to drought and soil drifting conditions, there were created some 52 District Experimental Sub-stations, each covering about 640 acres, and operated by practical farmers under the supervision of one of the Experimental Farms. Reclamation projects, designed to determine the best methods of handling severely drifted land, have been conducted in 17 areas. The problem of securing satisfactory stands of grass, either for reclamation, range improvement or as part of a farm rotation, has been studied experimentally in nearly 600 Regrassing Projects. On four large tree planting experiments and in thousands of smaller tree planting projects, the value of trees for shelter has been demonstrated and their potential value in controlling soil drifting is being studied. The production of crops under irrigation is being demonstrated under practical conditions, both on private and community projects. In the aggregate, nearly 100,000 acres of land have been used in experimental or demonstrational work under the P.F.R.A. program.

Special research under the P.F.R.A. has been in progress at each of the provincial universities in the Prairie Provinces. For the intensive study of soils, a Soil Research Laboratory was established in 1936 at Swift Current, Saskatchewan.

Contact with farmers in rehabilitation work is secured through the normal intercourse established by the Experimental Farms, supplemented by the

membership, amounting to 35,800 farmers, of 228 Agricultural Improvement Associations which have been organized under P.F.R.A. auspices, for specific community action on drought problems.

OBJECTIVES OF THE P.F.R.A. CULTURAL PROGRAM

The bulk of P.F.R.A. work conducted by the Dominion Experimental Farms has been directed to three main objectives; the control of soil drifting, the reclamation of drifted land, and the improvement of living conditions on prairie farms. In connection with this work, a considerable amount of research has been conducted on special problems related to the main objectives.

SOIL DRIFTING

Soil drifting is a permanent hazard to agriculture on the Canadian prairies. As long ago as 1859 Professor H. G. Hind observed soil drifting on the then unbroken prairies. In 1887 severe drifting occurred on the Experimental Farm at Indian Head, and in the surrounding district. At intervals throughout succeeding years drifting has caused damage to crops and land, particularly in southern Alberta during the period from 1918 to 1921. The tendency of prairie soils to drift seems to have increased with the length of time they have been under cultivation, while the area subject to drifting has gradually widened with the spread of settlement, extending in recent years into cleared areas of the northern wooded soils. Under the extreme drought conditions of the 1930-37 period soil drifting assumed alarming proportions.



Fig. 4.—Soil drifting was widespread on the prairies when the P.F.R.A. was started in 1935 and various emergency measures were developed to cope with the situation. Here drifting soil has been trapped by deep lister furrows and prevented from spreading.

Soil drifting is a natural result of prairie climate and prairie agriculture. Primarily, on the climatic side, drifting is caused by the action of strong winds on bare dry soil. In its virgin condition prairie soil is protected against drifting

by grass. Under the prevailing system of dry-land farming, however, in which summer-fallowing is an essential practice, from about one-third to one-half of the crop land is exposed in a bare cultivated condition to the erosive effects of wind during most of the year. Each year, therefore, a large acreage of prairie crop land is exposed to wind erosion, and this area is increased by crop failures during seasons of drought.

Another contributing factor is the reduction in soil organic matter which accompanies the replacement of grass by cultivated cereals.

Susceptibility to drifting is greater on sandy soils and clay soils than on loam soils. As regards sandy soils, the reason is obvious. The susceptibility of prairie clay soils to drifting arises from their chemical composition, which promotes a rapid "weathering down" to a powdery condition. Research conducted at the P.F.R.A. Soil Research Laboratory at Swift Current shows that drifting occurs most readily with soil particles ranging between 0.5 and 0.15 mm. in diameter, and that many clay soils on the prairies weather down to this range of particle sizes. In loam soils, however, there is a tendency for clay to adhere to the sand particles, increasing their dimensions above the critical range.

The principal adverse effects of drifting are injury to crops and deterioration of soils. Crops may be damaged by the abrasive action of wind-driven sand particles. This form of injury is of frequent occurrence in the early spring on sandy knolls, which may be denuded of growth in a few hours of strong wind. Another form of injury occurs when soil is blown away from the roots of young plants. In some cases, crops have been partially or completely buried by soil from neighbouring drifting areas. Damage to soil by drifting may range from the loss of some of the finer, relatively rich particles to complete removal of the surface soil and the formation of dunes and drifts. In the more serious cases the soil is rendered unfit for crop production, and becomes a menace to neighbouring areas. In addition to injury to crops and damage to land, soil drifting is productive of personal discomfort and inconvenience.

THE CONTROL OF SOIL DRIFTING

One outstanding result of the P.F.R.A. cultural program has been the demonstration that soil drifting can be controlled, even in bad seasons. Inasmuch as the bulk of soil drifting occurs on summer-fallow land, it is through adjustments in the practice of fallowing that the principal measures of control are effected. The methods of control are simple, involving the application of one or more of the following practices:—

Strip Farming.—The purpose of strip farming is to keep to a practical minimum the distance over summer-fallow land which strong winds can exert their erosive influence. This practice consists of growing crops in long narrow strips, usually 4 to 20 rods in width by 160 rods long, in alternation with similar strips of summer-fallow. By running such strips as nearly as possible at right angles to prevailing winds, the cumulative effect of drifting on the fallow strips is reduced.

The control of drifting by strip farming was tried by farmers at different points in the Prairie Provinces as early as 1918. Prior to the inauguration of the P.F.R.A. program, however, it had become a settled cultural practice only in a few southwestern districts, notably in the Monarch area of Alberta.

The Ploughless Fallow and Trash Cover.—For many years the standard method of summer-fallowing was to plough the fallow land in June, and thereafter to cultivate as required for weed control. By this practice all stubble and dead weeds, collectively known as "trash", were buried, leaving the surface soil unprotected by soil binding material. In the ploughless fallow the land is cultivated only with such implements as the one-way disk and ordinary culti-

vator which do not turn the soil completely over, leaving a "trash cover" to hold the soil against wind erosion. This practice owed its origin, in part, to the fact that it is somewhat more economical than the ploughed fallow.

The ploughless fallow has proved effective in controlling drifting on clay soils which, as already described, break down to a powdery condition. It is essential, of course, that sufficient trash be available to bind and cover the soil. Otherwise, emergency control measures, described below, may be necessary. On loam soils, which tend to crust on drying, the ploughed fallow may prove more satisfactory by resulting in a lumpy condition, whereas the ploughless fallow may cause undesirable pulverization.

Cover Crops.—In a few districts, particularly in the foothills area of southern Alberta, drifting on fallow during fall, winter and early spring has been controlled by means of autumn-sown crops of spring grain. These cover crops, sown around the middle of August at about one-half bushel per acre, make a light growth before the fall freeze-up and thereby retain some vegetative protection on the surface until seed time. This is accomplished with a minimum consumption of the moisture conserved by the fallow. This practice, however, has not proved very satisfactory in the drier areas, or where grasshopper infestations frequently destroy the emerging cover crop.

Emergency Measures.—Where crop land is totally devoid of vegetative protection, and a rough, lumpy tilth cannot be maintained, emergency measures of soil drifting control may be necessary. One such measure consists of spreading straw, hay, dead weeds or manure over the land. Another measure is to list the land into deep furrows at about three-foot intervals, forming a deeply corrugated surface which causes eddying and consequent slowing-up of surface air currents, and at the same time checks the scouring action of moving soil particles by trapping them in the furrows. The same effects may sometimes be secured by ploughing and rough cultivation. Whatever tillage method is employed for emergency control may have to be repeated several times before complete control is established, and every advantage taken of occasional showers to "puddle" the soil into coarse tilth. That emergency measures may prove costly is readily apparent.

Any one of the foregoing control measures may prove adequate, but generally a combination of measures is necessary. The choice of methods will depend on weather and soil conditions. In some districts strip farming may be the essential preliminary to good tillage practices, in others good tillage alone may suffice.

THE PROMOTION OF SOIL DRIFTING CONTROL UNDER THE P.F.R.A.

The principal methods under the P.F.R.A. of securing the adoption of soil drifting control measures by prairie farmers have been demonstration and co-operation, the first through the medium of the District Experiment Sub-Stations and the second through the formation of Agricultural Improvement Associations.

District Experiment Sub-Stations.—These Sub-Stations are essentially outposts of the Dominion Experimental Farms so distributed as to make accessible to all farmers in the P.F.R.A. area such services of the Experimental Farms in demonstration and experiment as will best aid in solving local problems arising from drought and soil drifting. Each Sub-Station is a private farm operated by the owner under direction of Experimental Farm officials, according to the best-known methods of dry-land crop production, with due regard to soil drifting control and the enhancement of farm living conditions. On these Sub-Stations, of which 47 were in operation in 1942, the various methods of soil drifting control outlined above have been compared and adapted to local conditions, thereby enabling local farmers to select the measures suited to their own particular conditions.

Agricultural Improvement Associations.—The function of these Associations, known popularly as A.I.A.'s, is to secure within a district, usually equivalent in area to one rural municipality, the large scale adoption of whatever cropping and tillage practices as will best control the menace of soil drifting and promote the general welfare of agriculture. In its origin the A.I.A. movement arose from the spontaneous co-operative action of farmers in a few isolated areas, with the uniform adoption of strip farming as their main objective. Prior to the organization of P.F.R.A. work, Strip Farming Associations had been formed at Shaunavon, Saskatchewan (1934); Aneroid, Saskatchewan (1935); Gull Lake, Saskatchewan (1935); and Limerick, Saskatchewan (1935). These associations derived their inspiration from the success of co-operative strip farming in the Monarch area of Alberta, and set the pattern of A.I.A. work in succeeding years.

Under the P.F.R.A. program the Dominion Experimental Farms have assisted in the organization of A.I.A.'s wherever local interest in the movement has been sufficiently keen. In addition, certain forms of assistance have been provided for these associations and their members. During the first five years of the program annual grants, based on the number of members, and ranging from \$50 to \$100, were made to each association. This form of assistance was discontinued after 1939. Assistance to members included personal advice on rehabilitation problems, and supplies of grass seed, trees, and other planting material not otherwise readily obtainable.

The success of the A.I.A. movement has been reflected in growth of associations and membership. During 1935 some 31 associations with 2,600 members were organized. By the end of 1942 there were 229 associations and 36,150 members. In eight years the A.I.A. movement had covered practically all of the problem districts and included in its membership approximately 21 per cent of the farmers in the P.F.R.A. area.

THE SUCCESS OF P.F.R.A. MEASURES FOR THE CONTROL OF SOIL DRIFTING

The measures introduced and promoted by the Dominion Experimental Farms for the control of soil drifting have been successful to a satisfactory degree. Wherever these measures have been adopted by the majority of farmers



FIG. 5.—A trash cover of stubble and weeds, left on the surface by the ploughless fallow methods, provides excellent protection against soil drifting. This method of cultivation has largely eliminated the use of the mould board plough on the open plains.

in a district, and this has occurred over quite extensive areas, the ravages of soil drifting have been stopped or materially reduced. Moreover, this desirable result was secured during the years of severe drifting prior to the return of more favourable weather conditions in 1938. Provided farmers remain alert to the possible recurrence of weather conditions conducive to drifting, there is little reason for this problem to resume its former magnitude.

Some indication of the success attending P.F.R.A. efforts for the control of soil drifting may be conveyed by the extent to which recommended control measures have been adopted by farmers. Strip farming, for instance, has become the established cropping practice on about 50 per cent of the Brown Soil Zone in Saskatchewan and Alberta, and on as much as 80 per cent of the more drift susceptible areas within that zone. Outside of the Brown Soil Zone the percentage of strip farming is less, about seven per cent in the Dark Brown Zone, and probably less than one per cent in the Black Zone. The ploughless fallow has been adopted on about 20 to 25 per cent of the crop land in Manitoba, on roughly 50 per cent of the crop land in Saskatchewan, and almost exclusively in the P.F.R.A. area in Alberta. The effectiveness of these practices has been definitely demonstrated on the District Experimental Sub-Stations, and their wide adoption, promoted through the activities of the Agricultural Improvement Associations, may be taken as evidence that the soil drifting conditions of recent years need not recur.

Emergency Soil Drifting Control.—One phase of Experimental Farm work which is particularly worthy of note has been the large-scale organization of farmers to combat emergency soil drifting over wide areas. In 1937 and early in 1938 soil drifting threatened to destroy several hundred thousand acres of crop land in the southwestern section of the drought area. To remedy this condition, resulting from crop failures which left the soil seriously deficient in trash cover, exceeded the resources of individual farmers or even groups of farmers. Under the auspices of the Experimental Stations at Swift Current and Lethbridge, however, farmers were organized to apply emergency control measures with equipment and tractor supplied, when necessary, by the Stations. Wherever possible this work was conducted through the local A.I.A.'s. The principal control measure employed was to list the land in strips as often as was necessary. This practice, while not entirely stopping the drifting, prevented it from assuming uncontrollable proportions, until crop growth could be started. In this manner severe drifting was controlled on some 300,000 acres of land.

LAND RECLAMATION

On many areas of light land, soil drifting had progressed to such a degree that the land was unfit for further cultivation. In addition to being of no value in agriculture, such areas constituted focal points of drifting which threatened nearby crop land. Moreover, while these drifted areas covered in the aggregate but a small acreage, they were so distributed as to menace a much larger acreage of good crop land. The imperative necessity of bringing such drifted land under control, and of restoring it to crop or grass production, led to the establishment by the Experimental Farms of a number of Reclamation Projects and Regrassing Projects.

The function of these reclamation projects was to determine the feasibility and best methods of, first, stopping soil drifting on abandoned land, and, second, of restoring such areas to their maximum production of either crops or grass. Seventeen of these projects have been established, covering 13,178 acres in the aggregate, and ranging in individual area from 46 to 3,200 acres.

The nature of the work conducted on different reclamation projects has varied considerably. At Melita, Manitoba, a Reclamation Station, covering 1,280 acres, was established in 1935 to determine the best methods of reclaim-

ing severely drifted land for crop production. This project has successfully developed into an experimental Sub-Station of considerable importance with experiments covering all phases of crop production relative to the drier sections of southwestern Manitoba. At Melita it has been demonstrated conclusively that severely drifted land can be reclaimed for crop production, provided soil and climatic conditions are reasonably good. Similar, though less intensive reclamation work to that at Melita was started in 1936 and 1,280 acres at Mortlach, Saskatchewan. At Mortlach the reclamation for crop production of soil of fair quality has been possible, but on very light soils the establishment of permanent grass cover appears to be the only feasible course.

The remaining 15 reclamation projects, of which 11 are in Saskatchewan and 3 in Alberta, were mainly directed to the re-establishment of grass cover on drifting submarginal areas. A typical project of this group is located at Cadillac, Saskatchewan, where three years of intensive effort were necessary to completely stop drifting on an 800-acre tract.

Methods of Reclaiming Severely Drifted Land.—From the results secured on reclamation projects over a period of five years, during which soil drifting conditions were decidedly bad, the following satisfactory technique for reclaiming bare drifted land has been developed.

- (1) Listing to produce a corrugated surface as previously described, is the most effective method of stopping drifting on bare land.
- (2) Seeding spring or fall rye, according to season, on listed furrows is a most effective method of establishing vegetative cover on bare land. This seeding is done when temperature and moisture will promote rapid germination. Best results have been secured by broadcasting the seed over the furrows, growth on the top of the listed ridges having shown a marked effect in checking drifting. Plants growing only in the bottom of listed furrows have frequently been destroyed by drifting from the exposed ridges. Where the land is very susceptible to wind erosion it has been found advisable to leave the mature rye crop unharvested. In milder cases the crop has been harvested, thereby repaying some of the cost of reclamation.
- (3) The final stage in the process of reclamation is to re-establish crop production under strip farming, and with proper tillage practices, or to seed the land down to permanent grass. On the majority of reclamation projects the latter course has been preferred.

The foregoing procedure has been used to reclaim some of the worst cases of soil drifting in Western Canada. The demonstrative value of this work has been great.

REGRASSING

The term regrassing implies the restoration of grass cover on prairie land which, by reason of soil drifting or low productivity, has been proved unsuitable for growing crops. In general, regrassed land is used for grazing. Under the P.F.R.A. program the Dominion Experimental Farms have conducted experimental and demonstrational work on regrassing along several major lines, as described below.

Regrassing Reclamation.—The final stage in most reclamation work is to seed grasses in standing, mature rye or other grain crop. The function of the grain is, of course, to shelter the tender grass seedling from drifting soil and excessive heat. In many localities, however, drifting soil may be stabilized by a heavy growth of weeds, notably Russian thistle. P.F.R.A. regrassing work has demonstrated conclusively that grasses, particularly crested wheat grass, can be successfully established in a stand of Russian thistles, and will eventually replace the thistles. By taking advantage of this fact some areas of otherwise useless land have been reclaimed at very low cost.

Regrassing Experiments.—In recognition of the importance of grass in land reclamation and the control of soil drifting, some 800 regrassing projects, combining the functions of experiments and demonstrations, have been located at representative points throughout the drought areas. These projects range from simple trials covering five or ten acres up to fairly elaborate experimental fields of several hundred acres. In estimating the value of this work of securing data on the technique of regrassing, and of demonstrating the results to farmers, it must be remembered that the cultivation of grass on submarginal land, received little interest or study prior to the recent drought crisis. As a result of the P.F.R.A. regrassing experiments, however, thousands of prairie farmers have become "grass conscious" and have been enabled to learn the best methods of regrassing under a wide range of conditions.

From the results of investigational and plant-breeding work on grasses and clovers, conducted on Experimental Farms, at the Dominion Forage Crop Laboratory at Saskatoon, Saskatchewan, on the Range Experimental Station at Manyberries, Alberta, and in the P.F.R.A. regrassing experiments, the following technique of regrassing prairie land has been developed.

REGRESSING TECHNIQUE ON THE CANADIAN PRAIRIES

The fundamental principle to be observed in securing good stands of cultivated grass on prairie lands is that every advantage of moisture and protection against wind erosion must be provided during the germination and seedling stages. Once established, provided the proper species have been used, stands of grass highly resistant to drought and other adverse conditions may be maintained.

Species and Varieties for Regrassing.—Crested wheat grass has proved to be the best cultivated grass for use on dry land, especially in competition with annual weeds. It is the only pasture herbage which has competed successfully with prairie sage on run-down range pastures. When sown in very dry seasons, crested wheat grass has lain inert for over a year, germinating satisfactorily with the return of good moisture conditions. For these reasons crested wheat grass is particularly suitable for regrassing work in Brown and Dark Brown Soil Zones. Crested wheat grass was introduced from Russia by way of the United States. The Fairway variety of this grass, selected by the University of Saskatchewan, is recommended for use in Canada.

Brome grass, while not so satisfactory as crested wheat grass on the Brown soils, is probably the better grass on Black soils. The value of brome as a trap crop for wheat stem sawfly justified its use in areas infested with this pest, even where crested wheat grass would give better yields. A new strain of brome grass, named Parkland, has been introduced by the Experimental Farms. Parkland differs from common brome grass in that it does not possess the objectionable creeping rootstalks of the latter.

Alfalfa and sweet clover are the principal legumes grown in the Prairie Provinces. Neither of these crops, however, have given good results on dry upland soils, but have proved useful in low moist areas. In general, sweet clover is more dependable, if less desirable, than alfalfa. Sweet clover, together with brome, is suitable for growing on alkali land.

For sloughs, on which water lies for part of the season, reed canary grass is satisfactory, while red top, brome and alsike grow well on slough margins.

Dates of Seeding.—The best time to seed grass on dry land has proved to be in the late fall or early spring. Fair results have been secured with early fall seeding, but very poor results with summer seedings. With alfalfa and sweet clover the best results have been secured by seeding in early spring.

Methods of Seeding.—As a general rule, grass sown on prairie land should be sown with a seed-drill, on soil protected by long stubble, or weeds. Seeding

with a nurse crop, as is done in humid regions, is not satisfactory on dry land. Broadcasting the seed has not given satisfactory results, nor has any method of seeding on bare land.

As regards the rates of seeding, P.F.R.A. experiments indicate that good stands of crested wheat grass may be secured by seeding in drills 12 inches apart at from 5 to 7 pounds per acre. Heavier seedings give thicker stands, but in a few years no difference can usually be observed between light and heavy seedings of crested wheat grass.

PROMOTION OF GRASS SEEDING THROUGH AGRICULTURAL IMPROVEMENT ASSOCIATIONS

With the object of promoting a wider use of cultivated grasses by prairie farmers, and especially of increasing the supply of seed of suitable species, particularly crested wheat grass, members of Agricultural Improvement Associations have been assisted in establishing grass seed plots. To this end small lots of grass and other forage seed, sufficient to sow from two to five acres, have been distributed by the Dominion Experimental Farms to all interested A.I.A. members.

During the first five years of the operation of the P.F.R.A. some 40,000 small lots of grass and other forage seed were distributed to members of associations. The total amount of seed distributed was approximately 500,000 pounds, consisting mostly of crested wheat grass, but with considerable quantities of brome grass, and smaller quantities of slender wheat grass, sweet clover and alfalfa.

The results secured by A.I.A. members in starting grass seed plots have been variable, and subject to many hazards, principally drought and inexperience. It has been estimated, however, that successful stands of grass or hay have been secured on plots which in the aggregate cover some 50,000 acres. Approximately 2,000,000 pounds of crested grass seed alone have been harvested from these plots, and the annual yield of seed, now that the plots are well established, will be greatly in excess of this figure. In view of the increasing demand for this seed, and of the insufficient supplies hitherto available, this phase of the P.F.R.A. program serves a useful purpose. In conjunction with the regrassing experiments, moreover, it has resulted in the wide dissemination of methods of regrassing among farmers who have had no previous experience or even interest in this work.

REGRASSING ON COMMUNITY PASTURES

The utilization of large tracts of abandoned farm land for grazing in Community Pastures has already been noted as the principal phase of Land Utilization work under the P.F.R.A. Much of the land in these pastures, previously cultivated, has been abandoned to weeds, while other areas have been overgrazed. Adverse climatic conditions during the drought years, moreover, have retarded any recovery by the somewhat slow natural process of regrassing. To overcome these obstacles to the speedy establishment of good grazing on Community Pastures artificial regrassing has been undertaken on a large scale. During a six-year period, 1937 to 1942 inclusive, some 93,000 acres of 30 Community Pastures have been seeded down, principally with crested wheat grass, but with brome, sweet clover and other grazing plants where conditions warranted. The actual seeding operations were conducted by the Experimental Farms at Brandon, Indian Head, Swift Current, and Scott. The cost of this work, using tractor-drawn batteries of seed drills, has worked out at 88 cents per acre.

The regrassing of community pastures has afforded unique opportunities for experimentation on a large scale, and information so gained will be very useful in the future conduct of this work.

GRAZING SURVEYS

In connection with the P.F.R.A. program of utilizing submarginal land for grazing purposes, and of devising improved methods of range land management, pasture surveys have been conducted for six years 1937 to 1942, by the Swift Current Experimental Station in a number of representative areas of range land. The principal object of these surveys is to determine the carrying capacity of various tracts of range land, having regard to soil, herbage, watering facilities, and various other consideration. Altogether, during the six-year period, pasture surveys have covered 3,384,000 acres. Some of these surveys have been made on individual ranches, while others have extended in "transects" over wide expenses of prairie. These transects provide fairly reliable information on grazing conditions over quite large regions. The results of these surveys provide guidance to both governments and ranchers in developing ranching policies.

SUMMARY OF REGRASSING WORK

From the inauguration of the P.F.R.A. program to the end of 1941 the Dominion Experimental Farms have been directly responsible for regrassing work on some 269,000 acres of land in the Prairie Provinces. A much larger acreage has been seeded by farmers as a result of P.F.R.A. demonstrations. There has been, therefore, an appreciable increase in the use of grass for the improvement of prairie agriculture.

TREE PLANTING IN THE PRAIRIES

Tree planting, with the object of improving living conditions on prairie farms, and of providing shelter to gardens and buildings against strong winds, has been practised in the Prairie Provinces for a number of years. Afforestation



FIG. 6.—A well planned shelterbelt serves to trap snow which provides extra moisture for the prairie garden and increased run-off for filling small reservoirs.

on the naturally treeless prairies has been at all times beset with difficulties arising from the dry climate. In the earlier period of prairie settlement difficulties were also encountered in the lack of both specialized knowledge regarding tree planting technique on the prairie and of suitable planting stock. To meet these difficulties the Dominion Government established a Forest Nursery Station at Indian Head in 1901, and later another at Sutherland, Saskatchewan, in 1914. In 1930 these Stations became units of the Dominion Experimental Farms Service. Since the inauguration of this service to the end of 1942, 186,051,261 trees have been supplied free to over 60,000 farmers in the Prairie Provinces. By this means a large number of tree plantations have been established on prairie farms.

Under the P.F.R.A. program special tree planting activities have been instituted in the drought area, involving the distribution of 14,361,296 trees. This work included the starting or enlarging of many demonstrational plantations, chiefly on District Experiment Sub-Stations, and the provision until 1940 of some financial assistance for tree planting on private farms. The distribution of seedlings has been continued, principally through Agricultural Improvement Associations.

FIELD CROP SHELTERBELT ASSOCIATION

The most distinctive phase of tree planting work under the P.F.R.A. however, is the experimental planting of large scale shelterbelt systems by Field Crop Shelterbelt Associations.

Four of these associations have been organized, each composed of farms located in a compact group covering approximately one township of 36 square miles. The operators of these farms have undertaken with government assistance to plant shelterbelts around their fields with the object of determining to what extent a fairly extensive system of shelterbelts will exert a beneficial influence on crop production by reducing the erosive and drying effects of strong winds and by trapping snow for the local increase of soil moisture. Farmers associated with the government in this work receive free tree seedlings, as well as financial assistance for planting and maintenance. The four associations in operation are located at Lyleton, Manitoba; Conquest, Saskatchewan; Aneroid, Saskatchewan; and Porter Lake, Alberta. By the end of 1942 these associations had planted 5,920,507 seedlings in a total of 698 miles of shelterbelt. The principal species planted has been caragana, with some ash, elm, and maple.

The largest and oldest of the shelterbelt associations is located at Conquest where, by the end of 1942, 383 miles of field shelters had been planted by over 70 farmers, representing the majority of farms throughout a rectangular area measuring seven miles by nine miles. This project was started in 1935 and despite some very adverse seasons, definite progress has been made in realizing the condition aimed at, namely, to surround each field in the selected area with tree shelterbelts or hedges. Evidence for or against the usefulness of these plantations should be available within a few more years.

The shelterbelt plantation at Lyleton, with 250 miles of hedges planted, is similar in plan to that at Conquest. The plantations at Aneroid (39 miles of hedges) and at Porter Lake (26 miles of hedges) are smaller.

GENERAL PROGRESS OF TREE PLANTING UNDER THE P.F.R.A.

During most of the period 1935 to 1939 P.F.R.A. tree planting work has been hindered by adverse factors, including drought, high winds and insect pests. Bearing in mind these handicaps the progress indicated by the following figures of trees planted is not inconsiderable. For the period under review the total number of trees planted under P.F.R.A. auspices was 14,361,296, of

which 7,920,640 were planted by Agricultural Improvement Associations, 335,264 on District Experiment Sub-Stations, 5,920,507 by Field Crop Shelter-belt Associations, and 202,885 in other P.F.R.A. projects.

Farm Home Improvement

The main objectives of this phase of the rehabilitation program are to improve the physical surroundings of prairie homes and to promote some degree of self-sufficiency as regards the production of food for domestic use on prairie farms. No field of work offers greater possibility of benefit for farm dwellers. The tonic effect on morale of attractive home surroundings, especially on the naturally treeless and somewhat featureless plains, is obvious. Self-sufficiency in the production of vegetables, fruits, milk, butter, eggs and meat will enable the farm home to survive many of the hazards attaching to a one-crop agricultural economy. At no time have these objectives been more important than during the recent drought years or in the present period of uncertainty with regard to the immediate future of wheat farming.

In one sense the entire P.F.R.A. program may be considered as directed at farm home improvement, since any enhancement of the farmers economic status is bound to have some beneficial influence on his standard of living. In the present consideration, however, attention is directed to the objectives mentioned above for the following reasons:—

1. The development of attractive surroundings for prairie farms has always been attended with considerable difficulty owing to the lack of sufficient moisture for the satisfactory growth of trees, flowers and vegetables. Furthermore, there was originally a dearth of suitable plant varieties for homestead plantations and gardens. Under the P.F.R.A. program of promoting small water-storage projects on individual farms, irrigation of farmstead trees and gardens becomes a possibility, while the long-time plant breeding program of the Experimental Farms has made available many hardy varieties of fruits, flowers and vegetables.

2. During the more prosperous period of the Canadian grain trade the full energy of many prairie farmers was directed to grain growing to the exclusion of other lines of agricultural production, even for domestic use. In effect, it was more economical to purchase butter, meat, eggs, vegetables and so forth with revenue derived from grain production, than to produce such food on the farm. This state of affairs has been sharply altered by the great reduction in farm revenues from grain production which accompanied the drought crisis. Many farmers have turned to the home production of whatever foods can be grown or raised on the farm, in order to secure some independence from the hazards attaching to grain production.

From the foregoing causes originated the P.F.R.A. program of farm home improvement. This program is being developed, largely through the Agricultural Improvement Associations along three lines:—

- (1) Water Development. (2) Planting of trees and ornamental shrubs.
- (3) Ornamental, fruit and vegetable gardens.

Water Development.—By the end of March, 1943, some 19,473 small water-development projects had been constructed on prairie farms as part of the P.F.R.A. program. To enable farmers to secure maximum benefit from these projects, the Dominion Experimental Farms have instituted a service of personal farm-to-farm assistance in irrigation methods. In this manner, many dry-land farmers without previous experience in irrigation are able to utilize stored water to advantage. Various types of irrigation schemes have been devised, ranging from small pumping projects for gardens to fairly pretentious systems for forage crop production. The benefits derived from this work are direct contributions to farm home improvement.

Tree Planting.—A brief description of the tree planting services provided for prairie farmers has already been presented. This work also makes direct contributions to farm home improvement.



FIG. 7.—The bleak surroundings of an unimproved prairie farm home afford little inducement to permanent home-making. For this reason tree planting is encouraged under the P.F.R.A. program.

Horticulture.—The development of hardy tree and bush fruits, early maturing vegetables and ornamental plants, all suitable for growing on the prairies, has been the object of plant breeding and plant selection work on appropriate Dominion Experimental Farms for over 45 years. The growing need for self-sufficiency in garden products and for home beautification has prompted the extension of the P.F.R.A. program to the field of horticulture. Through the Agricultural Improvement Associations many prairie farms have received encouragement, advice and sufficient seed and seedling supplies to enable them to start gardens. An interesting phase of this horticultural extension work has been the distribution of potato eye sets.

Potato Seed Distribution.—Potatoes, which form a staple article of diet, can be grown with fair success in prairie regions, even during the periods of cereal crop failure. One pre-requisite of satisfactory potato production is good seed. The drought crisis, however, caused a marked deterioration in the average quality of seed potatoes in the P.F.R.A. area. To remedy this condition the policy was adopted in 1939 of distributing small lots of seed potatoes to A.I.A. members, from which stocks of good seed could be grown. This work was undertaken in their respective districts by the Dominion Experimental Farms at Brandon, Indian Head, Swift Current, Scott and Lethbridge.

In order to secure a widespread distribution at a reasonable cost, the practice of sending out potato eye sets, properly treated against drying out, was generally adopted. In the majority of cases, 50 eye sets were sent to each applicant, with advice as to planting and a request for a report on results. In 1939, the peak year of distribution, some 19,000 parcels of seed potatoes were distributed, some 1,640 bushels of potatoes of suitable varieties being used for this purpose. The cost per parcel was in the neighbourhood of 17 cents.

While the results secured by farmers in growing these potatoes were variable, on the whole the project was successful. The average yield per lot of 50 eye sets was approximately 50 pounds, sufficient to plant an average garden plot of potatoes. The total production of potatoes from the entire distribution in 1939 is estimated at 17,400 bushels. By this means it has been possible to improve materially the quality of seed potatoes for planting in the P.F.R.A. area.

Special P.F.R.A. Cultural Activities

In connection with the Cultural Program, a number of specialized lines of work have been undertaken by the Experimental Farms, some in co-operation with other agencies. Chief of these lines of work have been soil survey, soil research, forage crop breeding, sawfly control investigations, and farm implement studies.

SOIL SURVEYS

The purpose of a soil survey is to determine the nature, extent and location of various types of soil. As an inventory of soil resources, a soil survey is of fundamental importance in the formulation of policies affecting land settlement and agricultural production. By classifying soil types, it affords a basis of comparison as regards productivity, adaptation of crops and methods of production.

Four main types of soil surveys have been conducted:—

1. *Broad Reconnaissance*.—This type of survey is exploratory in character, and predominant soil types are mapped on a scale of from three to six miles to the inch.
2. *Reconnaissance Survey*.—In which the soil types are mapped which can be conveniently shown on a scale of from two to three miles to the inch.
3. *Detailed Reconnaissance*.—In which soil types are mapped which can be conveniently shown on a scale of from one-half to two miles to the inch.
4. *Detailed*.—Includes all soil information which can be shown on large-scale maps. Detailed surveys are conducted in areas where special soil problems are being investigated.

Soil Surveys in Western Canada.—The first soil surveys in this region were conducted by the Topographical Survey of the Dominion Department of the Interior. These surveys, started in 1919 and discontinued in 1930, covered some 8,662,880 acres in nine isolated areas along the northern fringe of Prairie settlement.

Soil surveys under Provincial auspices, in many cases with financial assistance from the Dominion Experimental Farms, were started in Saskatchewan and Alberta in 1921 and in Manitoba about 1926. Prior to the inauguration of the P.F.R.A. program in 1935 soil surveys had covered 1,244,000 acres in Manitoba, approximately 60,281,000 acres in Saskatchewan and 11,360,000 acres in Alberta. In Alberta, land classification surveys covering 24,000,000 acres had been conducted in the sparsely settled northern part of the province, including the Peace River Area.

Soil Surveys Under the P.F.R.A.—The need for reliable information on soil with regard to various phases of rehabilitation work led, in 1935, to the acceleration of soil survey work in each of the three Prairie Provinces. In this work the Soils Department of the provincial universities co-operate under the P.F.R.A. with the Dominion Experimental Farms Service.

From the inauguration of the P.F.R.A. program in 1935 to the end of 1942 the total area covered by all types of soil surveys under the P.F.R.A. was 42,198,450 acres. Of this total 11,500,000 acres were covered by reconnaissance survey in Manitoba, and 22,071,800 acres by a reconnaissance survey and 30,000 acres by detailed survey in Alberta. In Saskatchewan, 1,752,000 acres were covered by detailed reconnaissance survey and 142,650 by detailed survey, and 6,702,000 by reconnaissance survey. Altogether, including work done prior to 1935, some 114,100,000 acres or over 90 per cent of the land within the P.F.R.A. area has been covered by some type of soil survey. For the three Prairie Provinces as a whole over 60 per cent of the total arable acreage has been surveyed.

SOIL RESEARCH

The purpose of soil research under the P.F.R.A. is to secure information on the nature and properties of prairie soils which shall contribute to a clearer understanding of the fundamental principles of prairie farming. This work has been conducted principally at the P.F.R.A. Soil Research Laboratory at Swift Current, Saskatchewan, and partly in co-operation with the Soil Departments of each of the three provincial universities.

Work of the P.F.R.A. Soil Research Laboratory, Swift Current, Sask., located on the Dominion Experimental Station at Swift Current.—This laboratory was opened in 1936, replacing a smaller laboratory which had been used for soil moisture investigations since 1922. The new laboratory is fully equipped for the chemical and physical investigations of soils, with greenhouse facilities, and is centrally located in the P.F.R.A. problem area. Major lines of investigation are: the relation between soil moisture and crop growth, the relation between soil properties and susceptibility to drifting, and the effect of irrigation on soil conditions.

Studies on soil moisture, conducted under controlled conditions, have shown that the chief beneficial effect of the cultivated summer-fallow was the destruction of moisture-consuming weeds, rather than, as was formerly supposed, the checking of evaporation through the maintenance of a soil mulch which would interfere with the capillary upward movement of soil moisture.

Some of the results of research conducted since 1936 with the aid of wind tunnels have been referred to on page 21 of this report.

Irrigation and Soil Conditions.—Work in connection with various P.F.R.A. irrigation projects, especially as regards saline soils, indicates that proper methods of applying water, together with suitable cultural practices, may enable crops to be grown under irrigation on such soils much more satisfactorily than where improper methods are used.

CO-OPERATIVE SOIL RESEARCH

Research on specific soil problems relative to the Cultural Program has been undertaken at each of the provincial universities in the Prairie Provinces, using university staffs and equipment and P.F.R.A. funds. In the University of Manitoba, Winnipeg, Manitoba, the subject of research was "The Quality and Composition of Crops as Influenced by Soil Type, Fertilizer Treatment and Climatic Conditions". At the University of Saskatchewan, Saskatoon, Saskatchewan, the problem studied was "The Nature and Treatment of Alkali Soils". Studies on "Soil Deterioration" have been conducted at the University of Alberta, Edmonton, Alberta. The results of these investigations, reported on in various P.F.R.A. annual reports, have increased existing knowledge of the properties of prairie soils.

FORAGE CROP BREEDING

Plant breeding problems in relation to forage crops for prairie agriculture are investigated by the Experimental Farms Service at the Dominion Forage Crops Laboratory, Saskatoon, in co-operation with the University of Saskatchewan. Certain phases of the work at this laboratory are conducted under the P.F.R.A. Cultural Program.

SAWFLY CONTROL EXPERIMENTS

The wheat stem sawfly causes considerable damage each year to part of the wheat crop on the Canadian prairies. Experiments conducted under the P.F.R.A. by the Experimental Farms in co-operation with the Division of Entomology of the Dominion Department of Agriculture, have progressed sufficiently to justify an optimistic outlook as regards the eventual control of this pest.

FARM IMPLEMENT INVESTIGATIONS

The extensive use in the Cultural program of various types of farm implements, especially those of new design, has afforded excellent opportunities for farm machinery investigations. Considerable information has been secured on the performance and relative usefulness of various implements under different conditions, and many new ideas have been contributed by Experimental Farm workers.

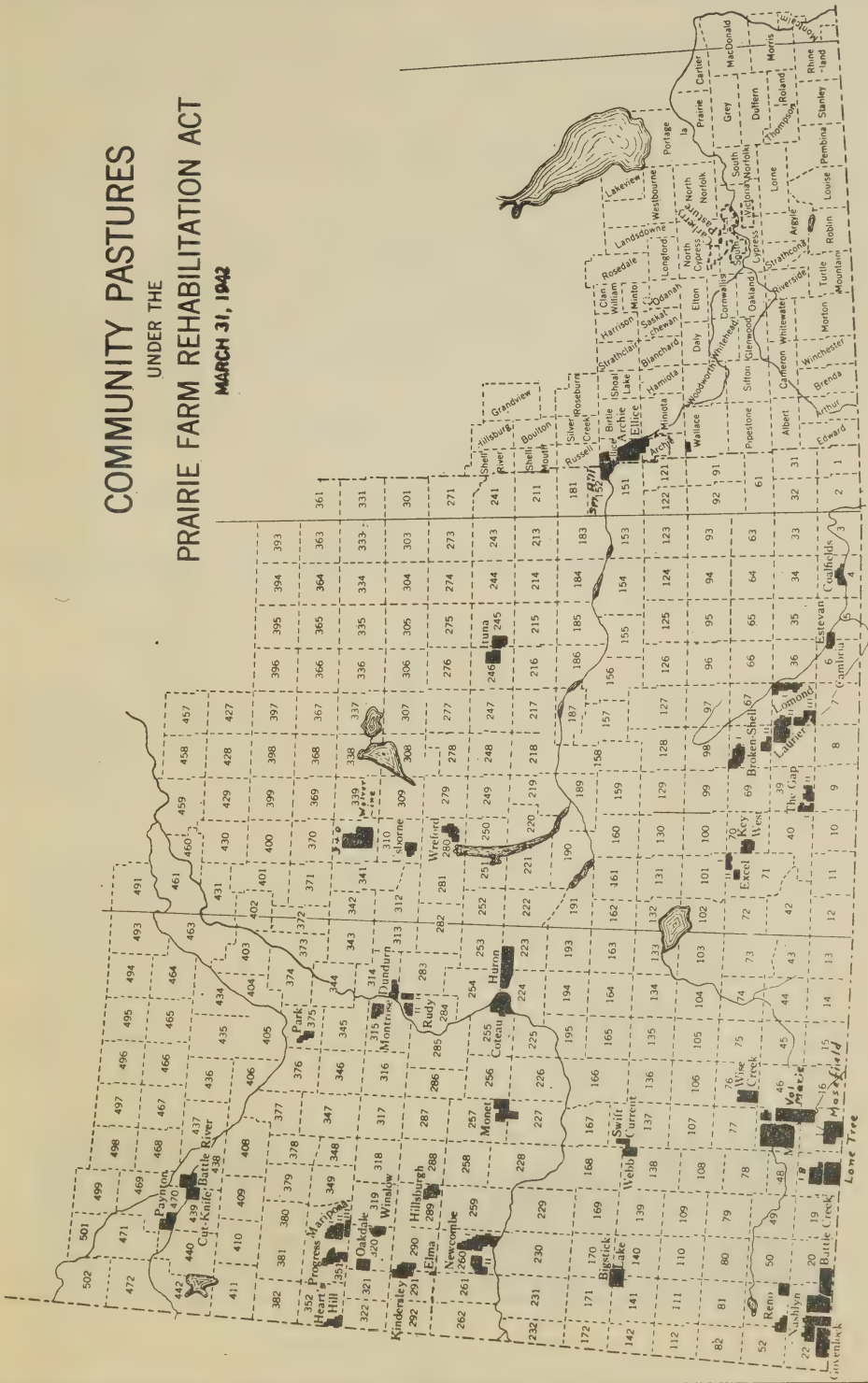
The P.F.R.A. Land Utilization Program

Throughout the agricultural region of the Prairie Provinces are scattered areas of land, of varying acreage which are unsuitable for crop production. The location and extent of all of these tracts has not yet been determined, but estimates of reasonable reliability place the proportion of submarginal land at about one-quarter of the settled area. Unsuitability for cultivation arises from one or more of several conditions, such as rough topography, excessive stoniness, alkali, light-textured soil with poor water-holding capacity and an inadequate supply of soil moisture. Individual submarginal areas vary in extent from a few acres to several hundred thousand acres. The existence of the larger submarginal tracts presents problems of land utilization which demand consideration and action on the part of local, provincial and national authorities.

An unfortunate phase in the history of the agricultural development of Western Canada was the settlement of many areas of submarginal land. Such settlement took place under the stimulus of unusually good crop seasons, when poor lands produced fairly good yields. Lacking or disregarding information on long-term climatic conditions, many settlers made investments in land and buildings, and secured social services, out of proportion to the intrinsic agricultural value of their lands. The inevitable results were the early abandonment of land and the creation of uncollectable debts.

An example of injudicious settlement on a large scale occurred in south-eastern Alberta. Much of the settlement in this region occurred during the "good" period which culminated in the "bumper" crop of 1915. Normal, dry conditions in the years following 1917, however, forced most of the settlers to abandon their holdings. Census returns for 1926 showed that, in Census District No. 3 of Alberta, which extends north and west from Medicine Hat, fifty-five per cent of the farm acreage was abandoned. To-day, the foundations of dismantled grain elevators are to be seen at many railway stations in this district. In other districts similar, if less extreme, results of injudicious land settlement have occurred.

COMMUNITY PASTURES UNDER THE PRAIRIE FARM REHABILITATION ACT MARCH 31, 1942



One consequence of the settlement and subsequent abandonment of submarginal areas has been the destruction of the original prairie grass. Natural regrassing of abandoned cultivated prairie land takes place only over a long period of years. In the interval, such land has little or no value as pasturage, and, infested with weeds and exposed to wind erosion, may constitute a menace to nearby arable areas.

A further evil which accompanies injudicious settlement is found on submarginal farms which have not been abandoned. Such farms have been aptly described as the "slums of the open prairie", where economical crop production is impossible, and where social services, if available, can only be maintained at a loss to the community. A large percentage of the cost of rural relief and of the losses arising from tax delinquencies which have been experienced on the prairies in recent years, can be charged to the existence of submarginal farming.

Recognition of the fact that correction of the conditions described above was essential to the rehabilitation of prairie agriculture led in 1937 to the organization of the P.F.R.A. Land Utilization Program. The major objectives of this program are:—

1. The permanent withdrawal of submarginal prairie land from cultivation.
2. The development of such areas for grazing purposes.
3. The resettlement on suitable farm land of farmers removed from submarginal areas.

In practice, these objectives are being realized through the organization of P.F.R.A. Community Pastures, and through various settlement schemes, chiefly on new irrigation projects.

COMMUNITY PASTURES

The P.F.R.A. Community Pasture has become a well-known feature of agricultural organization through a large extent of the Prairie Provinces. During 1942 community pastures were in operation on 64 separate tracts of submarginal land, covering an aggregate of 1,201,820 acres. For purposes of administration, these pastures have been organized into 45 units, each comprising from one to



FIG. 8.—Sixty-seven community pastures have been completed since this phase of P.F.R.A. was started in 1937. These projects cover $1\frac{1}{4}$ million acres of marginal land and in 1943 provided grazing for 50,000 head of stock.

three separate tracts, with a pasture manager in charge. For convenience, each administrative unit, rather than each separate tract of land, is referred to in this report as a Community Pasture.

In the following table is presented information showing the name given to each community pasture, the number of the Rural Municipality in which it is located, the pasture headquarters, acreage and carrying capacity. There is also shown the number of cattle and horses on each pasture as at September 31, 1942.

Additional data are given for three pastures, covering 59,280 acres, constructed in 1942.

The location of these community pastures is indicated on the map on page 35.

At this point it may be of interest to note the practice used in naming P.F.R.A. Community Pastures. In general, a pasture is named from the Rural Municipality in which it is located. Thus, the Coalfields pastures are located on two separate areas in the Rural Municipality of Coalfields, Saskatchewan, and are numbered 1 and 2 respectively. The Estevan-Cambria pasture is located partly in each of two rural municipalities. Where pastures are located in unorganized territory, however, local place names are used, as with the Beaver Hills, Battle Creek, Nashlyn, Govenlock, Val Marie and Beaver Valley Pastures.

Referring to the table on page 38, it will be seen that the estimated carrying capacity of existing community pastures is 38,325 head of live stock, and that during September, 1942, these pastures carried over 30,000 head of cattle and nearly 9,000 horses. These figures indicate that full use is being made by prairie farmers of the grazing facilities afforded by the Community Pastures.

Preliminary to establishing a community pasture, a survey is made of the area to determine the possibility of securing control of the land, the degree to which the tract is unsuitable for cultivation, and the relation of the area to surrounding farm land. In this survey use is made of municipal records, soil survey and economic survey data, and in some cases of P.F.R.A. debt surveys. The nature and possibility of improving the grazing is determined by means of a grazing survey by officials of the Experimental Farms.

Once control of the land in a projected pasture is secured, the area is enclosed and suitably sub-divided by strong fences, provided with stockwatering facilities and corrals, and regrassed where advisable. When the pasture is ready for use, a pasture manager is appointed, and grazing privileges are accorded at reasonable fees to stock raisers in the vicinity. Male breeding animals of suitable breeds of cattle are maintained in sufficient numbers on each pasture by the government. For the most part, community pastures serve mixed-farming rather than straight ranching interests.

In the management of community pastures, the pasture manager is appointed by and is directly responsible to the Land Utilization Branch of the P.F.R.A. Administration at Regina. This same authority also sets the scale of grazing fees, determines the total number of live stock to be admitted to each pasture, and makes major decisions on points of management. In this manner efficient control of the pastures is assured. To facilitate adjustment of the details of management to suit local requirements, a Grazing Association of pasture clients has been organized in connection with most of the pastures. The function of a Grazing Association, acting through an elected council of five members, is to assist the pasture manager in the allocation of grazing privileges, to determine what conditions as regards inoculation, vaccination and other treatment shall govern the admission of live stock, to select the breed of male breeding stock, and, in general, to assist the manager in the conduct of pasture business. Ultimately it is hoped that the entire management of each pasture shall be assumed by the Grazing Association, subject only to the restriction that the

TABLE 3
COMMUNITY PASTURES ESTABLISHED UNDER THE PRAIRIE FARM REHABILITATION ACT 1937-1942

| No. | Community Pasture | No. of R.M. | Headquarters of Pastures | Acres in Pasture | Carrying Capacity | Live Stock on Pastures September, 1942 | |
|--------------|---|-------------|--------------------------|------------------|-------------------|--|--------|
| | | | | | | Cattle | Horses |
| SASKATCHEWAN | | | | | | | |
| 1 | Coalfields No. 1 and 2..... | 4 | Sask..... | 9,300 | 360 | 227 | 60 |
| 2 | Estevan-Cambria..... | 5 and 6 | Estevan..... | 6,880 | 250 | 274 | 59 |
| 3 | Masefield..... | L.I.D. 17 | Masefield..... | | 800 | 384 | 88 |
| 4 | Lone Tree..... | 18 | Bracken..... | 32,960 | 775 | 615 | 107 |
| 5 | Lomond No. 1..... | 37 | Goodwater..... | 23,200 | 950 | 626 | 209 |
| 6 | {Lomond No. 2..... and Laurier.....} | 37 | Radville..... | 10,400 | 1,000 | 817 | 196 |
| 7 | Lomond No. 3..... | 38 | Goodwater..... | 24,000 | 402 | 400 | 200 |
| 8 | The Gap, No. 1 and 2..... | 39 | Ceylon..... | 18,270 | 600 | 503 | 136 |
| 9 | Reno, No. 1..... | 51 | Robsart..... | 11,840 | 450 | 424 | 84 |
| 10 | Reno, No. 2..... | 51 | Consul..... | 16,480 | 350 | 283 | 81 |
| 11 | Brokenshell, No. 1..... | 68 | Trossachs..... | 10,320 | 850 | 665 | 177 |
| 12 | Brokenshell, No. 2..... | 68 | Yellow, Grass..... | 21,600 | 400 | 340 | 56 |
| 13 | {Key West..... {Excel No. 1 and No. 2..... | 70 | Ogema..... | 8,800 | 350 | 1,115 | 378 |
| 14 | Auvergne-Wise Creek..... | 71 | Ormiston..... | 9,920 | 550 | 902 | 232 |
| 15 | Sharnook..... | 76 and 77 | Ponteix..... | 15,840 | 950 | 254 | 75 |
| 16 | Swift Current-Webb..... | 134 | Coderre..... | 27,520 | 250 | 354 | 141 |
| | | 137 and 138 | Beverly..... | 22,400 | 520 | | |
| | | | | 15,680 | | | |
| SASKATCHEWAN | | | | | | | |
| 17 | Big Stick No. 1..... | 141 | Maple Creek..... | 18,720 | 550 | 536 | 45 |
| 18 | Spy Hill..... | 152 | Spy Hill..... | 20,000 | 750 | 408 | 25 |
| 19 | Elbow (Huron and Maple Bush)..... | 223 and 224 | Elbow..... | 29,120 | 1,040 | 871 | 290 |
| 20 | Beaver Hill, Nos. 1 and 2..... | 245 and 246 | Parkerview..... | 44,160 | 1,320 | 1,856 | 477 |
| 21 | Coteau..... | 255 | Birsay..... | 26,000 | 700 | 1,622 | 109 |
| 22 | Monet Nos. 1 and 2..... | 257 | Hughton..... | 26,000 | 1,000 | 1,110 | 440 |
| 23 | Newcombe Nos. 1 and 2..... | 260 | Ghidden..... | 46,360 | 1,600 | 1,054 | 295 |
| 24 | Wreford Nos. 1 and 2..... | 280 | Hatfield..... | 54,560 | 4,400 | 476 | 143 |
| 25 | Rudy, Nos. 1 and 2..... | 284 | Wingello..... | 12,320 | 530 | 557 | 187 |
| 26 | Hillsburg, No. 1..... | 289 | Brook..... | 14,240 | 600 | 364 | 293 |
| 27 | Kindersley-Elma..... | 290 and 291 | Driver..... | 12,640 | 1,200 | 779 | 417 |
| 28 | Usborne..... | 310 | Venn..... | 22,680 | 700 | 618 | 329 |
| 29 | Dundurn..... | 314 | Dundurn..... | 12,720 | 650 | 647 | 181 |
| 30 | Montrose..... | 315 | Delisle..... | 20,480 | 500 | 435 | 84 |
| 31 | Oakdale Nos. 1 and 2..... | 320 | Beaufield..... | 11,680 | 500 | 582 | 509 |
| | | | | 20,320 | 750 | | |

| SASKATCHEWAN | | | | | | | | | |
|-----------------------------------|---|-------------|----------------|-----------|-----------|--------|--------|-------|--|
| 32 | Mariposa Nos. 1 and 2 and 3..... | 350 | KerRobert, | Sask..... | 29,760 | 1,000 | 1,002 | 551 | |
| 33 | Progress, Nos. 1 and 2..... | 351 | Onward, | "..... | 18,720 | 470 | 616 | 274 | |
| 34 | Heart's Hill..... | 352 | Compeet, | Alta..... | 16,000 | 550 | 469 | 308 | |
| 35 | Park..... | 375 | Langham, | Sask..... | 5,840 | 300 | 284 | 54 | |
| 36 | Battle River-Cutknife Nos. 1 and 2..... | 438 and 439 | Bresaylor, | "..... | 31,040 | 800 | 762 | 205 | |
| 37 | Paynton, Nos. 1 and 2..... | 470 | Paynton, | "..... | 20,969 | 700 | 468 | 213 | |
| 38 | Govenlock..... | 22 | Govenlock, | "..... | 44,720 | 1,100 | 1,056 | 45 | |
| 39 | Nashlyn..... | 21 | Consul, | "..... | 62,240 | 2,000 | 1,402 | 155 | |
| 40 | Battle Creek, Nos. 1 and 2..... | 20 | Vidora, | "..... | 67,640 | 2,200 | 1,399 | 271 | |
| 41 | Val Marie, Nos. 1 and 2..... | 47 | Val Marie, | "..... | 154,720 | 3,600 | 1,972 | 450 | |
| 42 | Beaver Valley..... | 47A | Beaver Valley, | "..... | 11,360 | 360 | 257 | 86 | |
| MANTOBA | | | | | | | | | |
| 43 | Ellice-Archie, No. 1..... | | Welwyn, | "..... | 42,400 | 2,000 | 691 | 162 | |
| 44 | Ellice-Archie, No. 2..... | | Foxwarren, | Man..... | 20,320 | 900 | 751 | 89 | |
| 45 | Wallace..... | | Elkhorn, | "..... | 3,280 | 250 | | | |
| TOTALS—Pastures in operation..... | | | | | 1,201,820 | 38,325 | 30,229 | 8,966 | |

CONSTRUCTED IN 1942 BUT NOT IN OPERATION

SASKATCHEWAN

| | | | |
|---------------------------|---------|-----------------------------|--------|
| Bigstick—Bitter Lake..... | 141-142 | Near Maple Creek, Sask..... | 33,760 |
| Wolverine..... | 340 | Near Guernsey, Sask..... | 13,280 |

MANTOBA

| | | | |
|-------------------------|--|-----------------------------|--------|
| Portage la Prairie..... | | Near Poplar Point, Man..... | 12,240 |
|-------------------------|--|-----------------------------|--------|

| | |
|-------------------------|-----------|
| TOTAL NEW PASTURES..... | 59,280 |
| TOTAL ALL PASTURES..... | 1,261,100 |

land be kept out of crop production. It is readily apparent, therefore, that the administration of community pastures combines some desirable features of both centralized and localized control.



FIG. 9.—Members of a P.F.R.A. community pasture Grazing Association hold their annual meeting to elect officers for the year and discuss business relating to the operation of the pasture.

Purebred bulls are provided by the P.F.R.A. Administration for the various pastures on the following basis: For the first three years of pasture operation the necessary bulls are supplied free. For the second period of three years, a charge of one-half rental basis is made against the pasture revenues for each bull. Thereafter, full rental charges are made. This rental is based on the average total cost of securing and maintaining a bull in service over a period of five years, and amounts at present to about \$35 per bull per year. By keeping one selected breed of bulls on each pasture indefinitely, it is hoped that the various pastures will eventually become centres of improved live stock breeding. As of March 31, 1942, there were 191 purebred bulls on community pasture service, including 101 Herefords, 82 Shorthorns and 8 Angus.

The fees charged for grazing privileges on community pastures are based on estimated costs of operation and maintenance. The entire original cost of establishing pastures is borne by the government as a contribution to the improvement of land use conditions on the prairies. For this reason, it is possible to keep fees at a moderate level. During 1942 the monthly grazing fees ranged from 30 to 35 cents per head for cattle, from 40 to 50 cents for horses, while 5 cents was set as the charge per head for sheep.

Each community pasture is a Game Preserve and Pound, the manager acting as game warden and poundkeeper.

Some idea of the magnitude of the Community Pasture program may be gained from certain details of the construction work involved. To enclose and sub-divide the pastures now in operation required the erection of 2,517 miles of fence. In the interests of permanency, these fences have been made with creosoted posts set at one-rod intervals. Five strands of barbed wire were used on outside fences, and four strands for cross fences. Each fence was built in 80-rod sections so that the loss of tension from broken wires might be localized.

Statistics relative to the rate of development and operation of P.F.R.A. community pastures are presented in Table 4.

TABLE 4
DEVELOPMENT AND OPERATION OF COMMUNITY PASTURES UNDER THE PRAIRIE FARM REHABILITATION ACT

| Fiscal Year | Number of Pasture Units in Operation | Area of Pastures in Operation Acres | Total Cost of Construction of Pastures in Operation | Live Stock Carried on Pastures | Acres per Head of Live Stock | Cost of Operations | | | | Net Operating Cost per Head | Average Charge per Head to Farmer |
|--------------|--------------------------------------|-------------------------------------|---|--------------------------------|------------------------------|--------------------|-------------|-------------|-------------|-----------------------------|-----------------------------------|
| | | | | | | Revenue | Expenditure | Net Surplus | Net Deficit | | |
| | | | \$ | | | \$ | \$ | \$ | \$ | \$ | \$ |
| 1938-39..... | 14 | 189,800 | 165,995.03 | 3,290 | 57.0 | 6,339.92 | 10,185.52 | | | 3.10 | 1.93 |
| 1939-40..... | 26 | 612,300 | 663,471.25 | 11,922 | 53.3 | 21,632.71 | 20,945.84 | 686.87 | | 1.76 | 1.81 |
| 1940-41..... | 35 | 884,500 | 1,004,305.91 | 23,764 | 38.1 | 43,451.56 | 35,291.05 | 8,160.51 | | 1.49 | 1.83 |
| 1941-42..... | 38 | 936,548 | 1,187,360.92 | 33,759 | 27.8 | 65,434.89 | 50,607.22 | 14,827.67 | | 1.50 | 1.94 |
| 1942-43..... | 45 | 1,261,100 | 1,298,487.54 | 53,759 | 23.4 | 98,292.32 | 79,906.76 | 18,385.56 | | 1.49 | 1.83 |
| TOTAL..... | | | | | | 235,151.40 | 196,936.39 | 42,060.61 | 3,845.60 | | |

N.B.—This table does not include data relative to the Wallace Community Pasture of 3,280 acres in Manitoba, which was constructed under the P.F.R.A. in 1939 at a cost of \$3,051.55 but has been operated entirely by the Rural Municipality of Wallace, Manitoba.

Another important item of pasture development has been the provision of water for stock. This has involved the excavation of dugouts, construction of stockwatering dams, sinking of wells and clearing of springs on a scale sufficient to locate watering places at intervals of about four miles throughout pasture areas. Considerable ingenuity has been displayed by fieldmen in this work.

On the majority of pastures it has been necessary to seed grass on areas of abandoned cultivation or overgrazing. To March 31, 1943, grass seed, mostly of crested wheat grass, has been sown on 93,000 acres in 30 community pastures. This work has been done by the staffs of Dominion Experimental Farms located near the various pastures. The high degree of success which has been secured in these seedings was made possible by the regrassing investigations of the Experimental Farms, as described in the Cultural section of this report.

The total cost of construction of community pastures, covering 1,261,100 acres, to March 31, 1943, was \$1,494,636.22. The average cost of construction, therefore, was \$1.18 per acre.

So far, community pasture development under the P.F.R.A. has been confined to Saskatchewan and Manitoba. In Alberta, the removal of submarginal land from crop cultivation, and the utilization thereof for grazing is the function of the Special Municipal Areas Board of Alberta. This Board was set up in 1923, following investigations of the Southern Alberta Survey Board into conditions arising in southern Alberta after the drought of 1919-1921. The Special Municipal Areas Board has over 8,000,000 acres of submarginal land under its control. In the territory of this Board a considerable amount of P.F.R.A. Cultural and Water Development work has been conducted.

In the preceding table it will be observed that the bulk of community pasture acreage came into operation in the years 1938 and 1939. The subsequent reduction in the rate of development was partly due to wartime retrenchment and partly to the fact that the more readily available tracts of submarginal land were developed at the beginning of the program.

The numbers of live stock carried each year on community pastures has increased steadily. During 1938, only 3,227 head of live stock were carried on 189,800 acres, or one head per 57.0 acres. The following year 11,534 head were carried on 612,300 acres, but the average of 53.1 acres per head was not much better than in 1938. Two reasons for these low numbers of live stock on pastures can be given: In the first place, the actual carrying capacity was somewhat low, as the various pasture improvement measures, such as regrassing and controlled grazing, had not yet exercised their full effect. Secondly, it took some time for farmers to realize the advantages offered by community pastures and in some cases to secure the live stock necessary to benefit thereby. Later these obstacles to the full utilization of community pastures became progressively less apparent, as the acreage grazed per head of live stock dropped to 38.1 acres in 1940, 27.8 acres in 1941, and 23.4 in 1942. Part of this improvement must be attributed to the increasingly attractive prospects for live stock production, arising from war conditions; but in a very considerable degree the credit is due to improvements effected in actual grazing conditions. Preliminary returns for the 1942 season indicate that full use continues to be made by farmers of community pastures.

Steady improvement has also been effected in the fiscal aspects of pasture operation. In 1938 operations were conducted at a loss of \$3,845.60 for all pastures. In 1939 there was a surplus of \$686.87, of \$8,160.51 in 1940, and of \$14,761.63 in 1941, while a surplus reserve of \$18,385.56 was created as a result of 1942 operations. As the level of grazing fees remained practically constant through 1939, 1940, 1941 and 1942, this progressive improvement in financial operations may be attributed to increasing carrying capacity, greater utilization,

and improving management of pastures. The column in Table 4, entitled "Operating Cost per Head" shows a progressive decrease from year to year, while the "Average Charge per Head to Farmers" remains nearly constant.

Several important findings have been made in connection with the development and management of P.F.R.A. Community Pastures. Experience has shown, for instance, that pastures in which less than from 15,000 to 20,000 acres can be supervised by one pasture manager are likely to be expensive in operation. This fact excludes smaller tracts of submarginal land from the community pasture program. Another finding is that it takes about two years to get an average pasture into economical operation. This factor, of course, operated with greater force in the pastures which were developed in the earlier period of the program.



FIG. 10.—Water is made available in all P.F.R.A. community pastures by means of reservoirs or wells.

A factor of prime importance in the successful management of community pastures has been the efficiency of the pasture manager. The ideal pasture manager would be industrious, have a good working knowledge of live stock management, be apt at business and possess sufficient tact and strength of character to acquire and retain the confidence of the pasture patrons. No degree of excellence in centralized management can offset serious deficiencies in pasture managers. That the community pasture program affords an opportunity for the development in pasture managers of the foregoing qualities of leadership in prairie live stock production is an incidental contribution of the P.F.R.A. of considerable merit.

The Future of Community Pastures.—In so far as existing pastures are concerned, the future of this phase of P.F.R.A. work would seem to be assured. Future development of new pastures, however, is rendered somewhat uncertain by the war emergency. Preliminary surveys, however, have been made of 75 proposed community pastures, covering an aggregate of 1,573,840 acres. The development of the above areas, together with the 1,261,100 acres already in existing pastures, would result in the permanent removal from cultivation, and

the utilization under controlled grazing, of 2,834,940 acres of submarginal land. Such a development would constitute no mean contribution to the solution of land-use problems in Western Canada.

The Prairie Farmer and Community Pastures.—To farmers located within convenient distance from the various pastures, the services provided therein are of distinct benefit. For little if any more than the cost of using ordinary leased rangeland, a farmer can secure good grazing for his live stock, and is relieved to a considerable extent of the trouble of supervision. In the case of the farmer whose land is practically all under cultivation, with little or no pasturage, and who can provide for winter feeding, this service is a decided boon. It makes possible a greater degree of mixed farming than heretofore, with advantages brought out during recent periods of economic adversity. The facilities provided on community pastures for improved breeding is a further advantage. Moreover, through the Community Pasture Grazing Association, the farmers are able to participate in the management of the pastures and in the formulation of policies. There is considerable promise, therefore, that the P.F.R.A. community pasture program will, in addition to solving land use problem, stimulate a progressive live stock production program among prairie farmers.

RESETTLEMENT UNDER THE P.F.R.A.

In general, agricultural settlement in Canada comes under provincial jurisdiction. For this reason, P.F.R.A. resettlement work has been largely limited to the relocation of farmers removed from community pastures, and to settlement on large P.F.R.A. irrigation projects. One exception occurred in 1936 when the P.F.R.A. organization co-operated with provincial authorities in transferring 63 farmers from dried-out areas in Saskatchewan to better locations elsewhere, by paying freight charges on effects and live stock.

Relocation of Farmers Moved from Community Pastures.—In the development of community pastures, over 200 farmers have been moved to new locations, in some cases with provincial assistance, to suitable holdings near the pastures, in other cases to new P.F.R.A. irrigation projects. As the latter method of resettlement presents certain interesting possibilities, a description at this point of the Rolling Hills Irrigation Project, one of the more important P.F.R.A. settlement projects, may be in order.

Rolling Hills Irrigation Project.—This project forms part of the Eastern Irrigation District in Alberta. It possesses certain features which are highly desirable in an irrigated land settlement program. In the first place, it covers a solid block of some 25,000 acres of hitherto uncultivated land, the topography of which permits easy distribution of irrigation water. Secondly, both soil and climate are suitable for the economic production of irrigated crops. Thirdly, the necessary water storage and main canals for bringing adequate water supplies to the project are already in existence, having been constructed years ago by the C.P.R. Details of this construction will be found on page 55 under Water Development.

Development of the Rolling Hills project, specifically to provide for the resettlement of farmers moved from dried-out areas, was started in 1937 as a co-operative program between the Eastern Irrigation District and the P.F.R.A. organization. Under this arrangement, irrigable land is made available by Eastern Irrigation District to settlers selected by the P.F.R.A. Land Utilization Branch. The District provides the main water supplies, constructs roads and assists in the introduction of various social services. Preparation of land for irrigation farming and supervision of settlement is undertaken by the P.F.R.A. Land Utilization Branch. Actual supervision of land preparation, and practical

assistance to settlers in acquiring the necessary irrigation technique, as concerns the proper location and construction of field ditches for spreading and draining irrigation water, time and rate of applying water and the selection of suitable crops, is provided by irrigation specialists from the Dominion Experimental Station at Lethbridge, Alberta.

Irrigable land in the Rolling Hills project is apportioned as follows: Allotments are confined to quarter sections. One quarter in each section is reserved for settlers from dried-out areas in Alberta. The remaining three quarters are open for settlement to farmers removed from community pastures in Saskatchewan. Settlers are given a lease option for the first two years of occupancy, after which a sale contract may be offered by the District if the settler is likely to prove satisfactory. Sale price of the land is \$8 per irrigable acre. Settlers pay an annual water rate of \$1.60 per irrigated acre, plus 10 cents per acre for hail insurance. The foregoing conditions of sale and occupancy are designed to afford reasonable opportunity to eligible settlers and at the same time protect the project from undesirable exploitation.

Very promising results have attended the Rolling Hills development. By the summer of 1942 settlers had been placed on 180 quarter sections. In only three cases have settlers proved unsatisfactory. By 1942 a large proportion of the land in this project, which in 1937 was open range, was under irrigated crops, largely grain and alfalfa. The area is well adapted to the production of vegetables for canning. In 1942 over 3,000 acres were under peas for seed, the absence of the pea-weevil, destructive elsewhere, being a point in favour of this crop in the Rolling Hills area. Some 1,500 acres of peas were under contract for the production of seed for shipment to England.

Other Irrigation Projects.—Other P.F.R.A. irrigation projects which offer settlement possibilities are located in the Province of Saskatchewan at Val Marie, Eastend, and Maple Creek. These projects, with an aggregate of 11,945 acres now under irrigation, and with room for some expansion, afford opportunity for the eventual settlement of over 200 farmers. In each of these

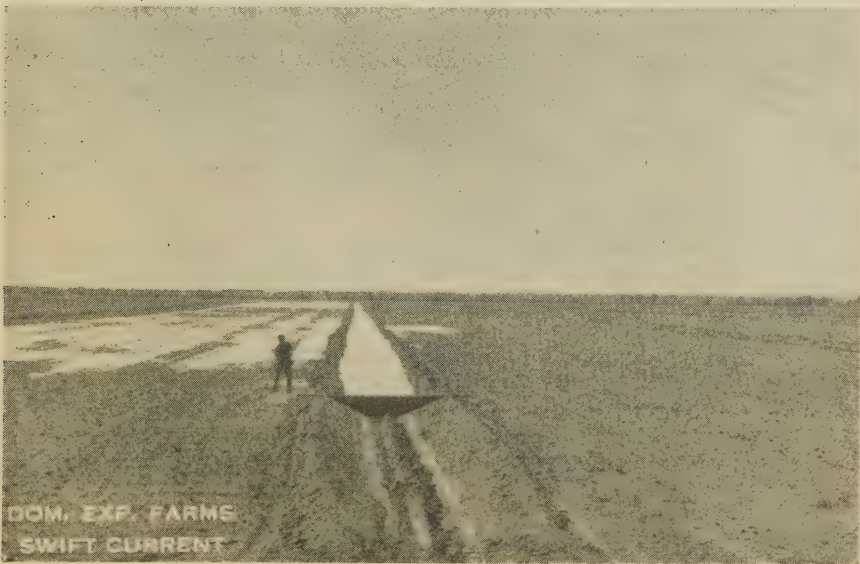


FIG. 11.—Irrigating on the Val Marie project—the valley of the Frenchman River, south central Saskatchewan. P.F.R.A. works of this kind have been completed to irrigate about 25,000 acres and assistance has been given in repairing or completing existing projects involving 78,000 acres.

projects, all of which are adjacent to extensive acres of rangeland, the policy is adopted of disposing of irrigable land in small blocks of from 40 to 60 acres, with the object of promoting the production of forage crops as reserve or supplementary feed for range live stock. In 1941 there were 5 settlers operating under leases on the Val Marie project, 30 at Eastend, and 12 at Maple Creek. Increased settlement at these points is in progress.

A new irrigation project with considerable settlement capabilities is under construction at Swift Current, where storage and canal facilities are being developed to serve some 25,000 acres of dry lake and river bottom lands.

Economic Research

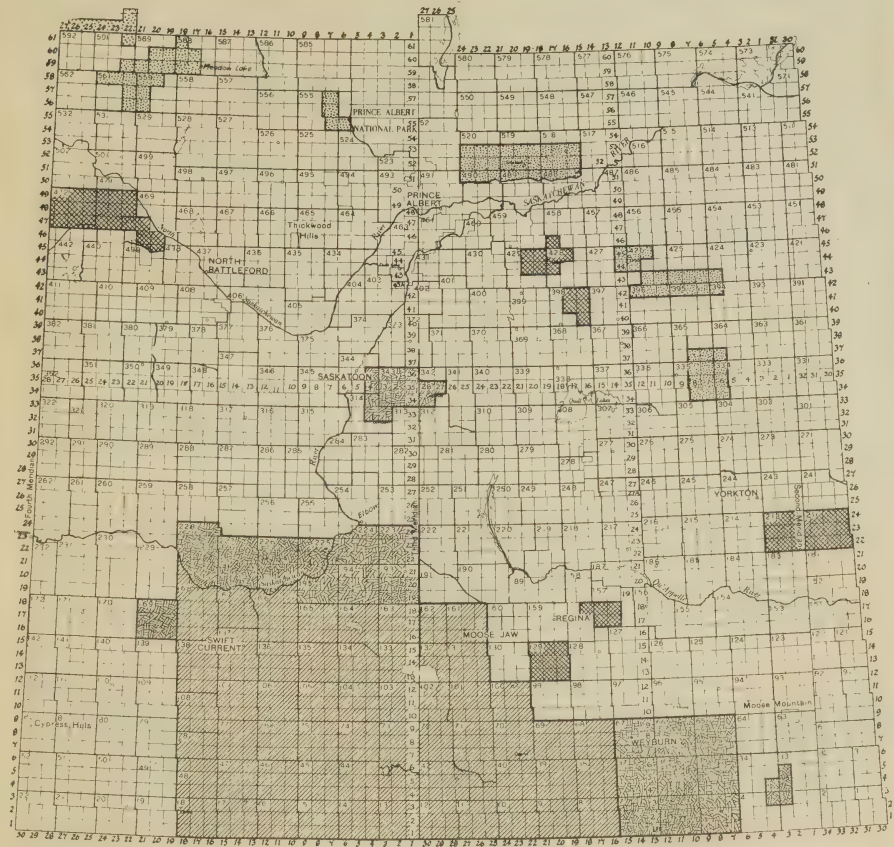
With the inauguration of a program of Prairie Farm Rehabilitation came an expansion in economic research in problems related to land utilization particularly in the Provinces of Saskatchewan and Alberta in which these problems were most acute. The additional funds necessary were provided under the Prairie Farm Rehabilitation Act. In the development of this program, the Economics Division of the Dominion Department of Agriculture, the Department of Farm Management, University of Saskatchewan, and the Department of Economics at the University of Alberta undertook co-operative projects commencing in areas in which the problems of adjustment appeared to be most acute. In planning this work, it was realized the recurring periods of low crop yields indicated that some adjustment in prairie agriculture would be necessary. In considering these adjustments, the first step was that of taking stock of and classifying land resources on the basis of relative productivity over a long enough period of years that a reliable index of productivity might be developed. During 1935, major emphasis was placed upon obtaining information which would provide a method of land use classification. In the years 1936 to 1940, nearly 25 million acres of land have been classified in the two provinces, 15,560,000 acres in Saskatchewan and 9,152,000 in Alberta.¹

In Saskatchewan the classification has been completed in a triangular area stretching from Rural Municipality No. 5 (Estevan), northwesterly to Municipality 223 (Elbow), west to No. 228 (Lacadena) and directly south to No. 18 (Climax) on the United States boundary. In addition, Municipality No. 343 and part of Municipality No. 342 have been classified. In Alberta, the area surveyed includes the Special Areas of Neutral Hills, Sounding Creek, Tilley East, Berry Creek and Bow West as well as Rosenheim and Acadia Valley, municipalities in the east central section of the Province and Municipalities Nos. 8, 9, 39, 69, 70 in the southwest corner of the Province. The smaller area classified in Alberta is due to necessity of carrying on a study of irrigation farming which was undertaken in 1940.

Land use classification may be conducted with various objects in view and the method of classification will vary with the purpose. The objectives in view in the land use classification referred to here may be summarized as follows:—

- (1) To serve as a guide to (a) those responsible for administering rehabilitation policies, for the development of community pastures and for the adjustment of population to the productive capacity of the land; (b) those charged with instituting and maintaining community services and the levying of assessments for such purposes; (c) loan appraisers and others interested in establishing land valuations and debt carrying capacities of land.
- (2) To aid the farmer or the prospective farmer in determining the opportunity for income in one district or on a particular farm as compared with another district or another farm.

¹See maps on pages 47-48 for areas in which economic research projects have been carried on. Area included in the ranch management study has not been shown.



AREAS IN WHICH ECONOMIC
RESEARCH PROJECTS HAVE
BEEN CONDUCTED IN

SASKATCHEWAN

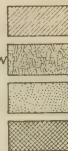
1935-1942

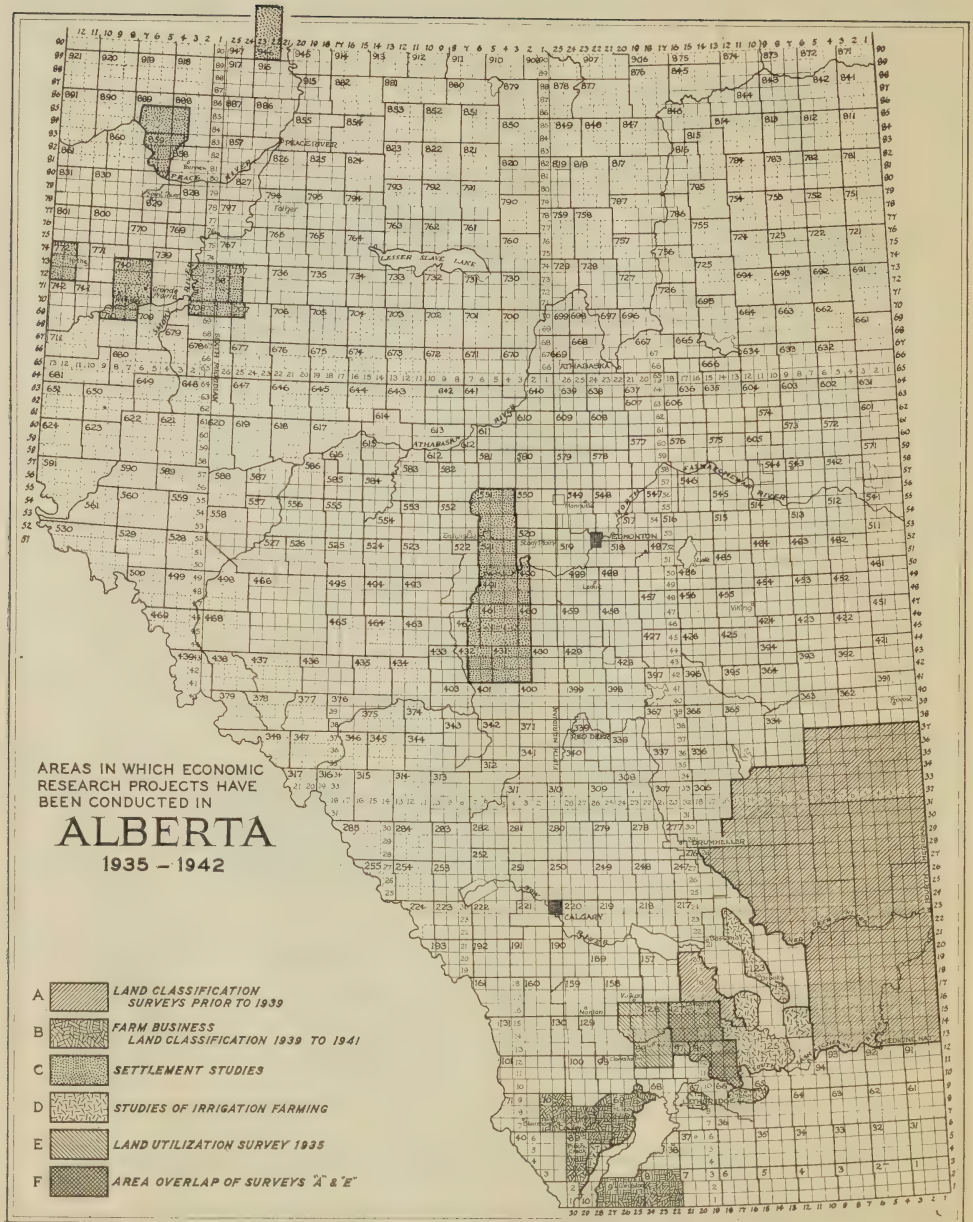
LAND CLASSIFICATION SURVEYS
PRIOR TO 1939

FARM BUSINESS - LAND CLASSIFICATION
1939 TO 1941

SETTLEMENT STUDIES

TENURE STUDIES





It is important to observe that the classification has been based upon a typical wheat growing unit in respect to size, equipment and management. This is consistent with the actual situation in the areas classified. Further it must be borne in mind in interpreting this classification that land placed in Land Class I, submarginal, may be above the margin for some other use. In fact the classification implies this when it is suggested that Land Class I is land better adapted to ranching than to wheat raising. It should be borne in mind that the classification established is designed to enable the use of land in the most effective manner.

An overall picture of land classification is difficult without maps but perhaps the general situation may be illustrated by the two tables which follow:—

ACREAGE AND PERCENTAGE OF TOTAL LAND AREA IN EACH LAND CLASS FOR SIXTY-FIVE MUNICIPAL UNITS, 1936-1939, SOUTH CENTRAL SASKATCHEWAN, EYEBROW-LACADENA AREA, 1940, and WEYBURN-ESTEVAN AREA 1941 ECONOMIC SURVEYS

| Land Class | Sixty-five Municipal Divisions | | Eyebrow-Lacadena | | Weyburn-Estevan | |
|------------|--------------------------------|----------|------------------|----------|-----------------|----------|
| | Acres | Per cent | Acres | Per cent | Acres | Per cent |
| I..... | 5,316,815 | 39.4 | 784,389 | 40.4 | 527,927 | 28.7 |
| II..... | 2,440,460 | 18.1 | 322,575 | 16.6 | 528,794 | 28.8 |
| III..... | 3,844,718 | 28.5 | 539,945 | 27.8 | 742,682 | 40.4 |
| IV..... | 1,520,946 | 11.3 | 139,537 | 7.2 | 21,970 | 1.2 |
| V..... | 362,882 | 2.7 | 156,588 | 8.0 | 16,557 | 0.9 |
| Total..... | 13,485,821 | 100.0 | 1,943,034 | 100.0 | 1,837,930 | 100.0 |

DISTRIBUTION OF LAND CLASSES BY AREAS—ALBERTA

| | I | II | III | IV | All land classes |
|---------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| | Prop. all parcels in area | Prop. all parcels in area | Prop. all parcels in area | Prop. all parcels in area | Prop. all parcels in area |
| | % | % | % | % | % |
| Neutral Hills..... | 70.08 | 18.70 | 10.80 | 0.42 | 100.0 |
| Sullivan Lake..... | 75.00 | 17.78 | 6.75 | 0.47 | 100.0 |
| Sounding Creek..... | 80.32 | 18.62 | 0.91 | 0.15 | 100.0 |
| Berry Creek..... | 94.14 | 4.65 | 1.12 | 0.09 | 100.0 |
| Tilley East..... | 88.32 | 8.50 | 3.18 | — | 100.0 |
| Bow West..... | 60.10 | 24.95 | 8.36 | 6.59 | 100.0 |
| Special Areas..... | 80.78 | 13.98 | 4.37 | 0.87 | 100.0 |
| Rosenheim..... | 60.42 | 14.00 | 15.63 | 9.95 | 100.0 |
| Acadia Valley..... | 56.43 | 19.03 | 15.26 | 9.28 | 100.0 |
| Surveyed Area..... | 79.63 | 14.15 | 4.92 | 1.30 | 100.0 |

In the first table, the percentage of land in the different classes varies as one might expect. It will be observed that 39.4 per cent of the land was placed in Land Class I (submarginal), 18.1 per cent in Land Class II (marginal), 28.5 per cent in Land Class III (fair), 11.3 in Land Class IV (good), and 2.7 in Land Class V (excellent). In the Eyebrow-Lacadena area, 8.0 per cent was in Land Class V. In the Weyburn-Estevan area, 40.4 per cent was in Land Class III.

In the area surveyed in east-central Alberta, 79.63 per cent was in Land Class I, 14.15 per cent in Land Class II, 4.92 in Land Class III, 1.30 in Land Class IV, and none in Land Class V. This is an area in which problems of land use adjustment has been extremely acute. Farm abandonment in some districts has been very high.

The results of these studies in land classification are in part published in the following bulletins:—

Physical and Economic Factors Related to Land Use Classification in Southwest Central Saskatchewan, Dominion Department of Agriculture Technical Bulletin No. 15.

An Economic Study of Land Utilization in Southern Alberta, G. H. Craig and J. Coke, Dominion Department of Agriculture, Technical Bulletin No. 16.

An Economic Classification of Land in Fifty-six Municipal Divisions in South Central Saskatchewan, C. C. Spence and E. C. Hope, Dominion Department of Agriculture, Technical Bulletin No. 36.

Land Use Classification in the Special Areas of Alberta and Rosenheim and Acadia Valley, A. Stewart and W. D. Porter, Dominion Department of Agriculture, Technical Bulletin No. 39.

An Economic Classification of Land and Its Relation to Farm Income in the Eyebrow-Lacadena Area, Saskatchewan, C. C. Spence, R. A. Stutt and S. Mysak, mimeograph publication, Economics Division, Dominion Department of Agriculture, Ottawa.

Associated with land utilization are many other economic and social problems—for example, the collection and analysis of farm management data. Twenty-one hundred and five detailed farm business records have been taken in Saskatchewan since 1939 in connection with land classification. In addition, 972 records were used as a basis for the settlement studies. In Alberta apart from yield histories, 800 farm business records have been obtained and 678 settlement records have been analyzed. Farm management data are essential to provide guides to the farm business set up which may be most profitable.

Ranch Management.—In 1939 in co-operation with the Experimental Farms Service, a study of cattle ranch management was undertaken in Saskatchewan, Alberta and British Columbia. British Columbia was included in this study because an analysis of the ranching business could not be complete without comparable data from that province. It may be noted that with large areas designated as submarginal for wheat production, the importance of the range is increased. There is thus a close relationship between the problems of land classification and ranch management. This study was planned as a three-year project in order that thoroughly representative data might be secured. Mimeograph reports were issued to co-operators at the end of the first and second years of the study and also had limited distribution among administrative and ranch officials. Information was secured from 316 ranchers representing a very substantial sample of the ranching business. Ranches ranging in size from 100 to 199 head of cattle were the most common sizes. Fifty-three per cent of the ranches had less than 200 head, 38 per cent had from 200 to 799 head and 9 per cent reported numbers ranging from 800 to 3,199 head.

Capitalization of the ranches in the second year of the study varied from \$19,301 in the northern Prairie Zone to \$47,930 in the Foothills of Alberta, cattle represented 28 per cent of the ranch capital in the Northern Prairie Zone and 41 per cent in the Chilcotin Zone in British Columbia.

Cash receipts ranged from \$3,711 in the Cypress Hills Zone to \$8,228 in the Foothills. Receipts from cattle varied from 66 per cent in the Northern Prairie zone to \$6,896 or 91 per cent of the cash receipts in the Chilcotin area.

Operating expenses in 1930-40 averaged \$1,455 per ranch in the Cypress Hills area compared with \$4,090 in the Foothills Zone. Labour was the largest item of expense.

The return to capital averaged 4.20 per cent in the Cypress Hills Zone and 13.13 per cent in the Chilcotin.

The analysis of the business of these ranches will supply information to ranchers from actual experience in successful ranch management which may be used in planning other ranch outfits. It will enable administrators of range lands to obtain valuable information hitherto not available.

In connection with this study a number of coloured still photographs were taken which will be of value in discussions of results of the study with ranchers and others.

Irrigation Farming in Alberta.—As previously indicated land classification studies in Alberta were curtailed in 1940 to enable a study of irrigation farming in the southern part of the Province to be carried out. There were in 1939 approximately 4,380 irrigation farmers in Alberta operating 507,000 acres of land under water contract or 116 acres of irrigable land per farm. The most common size of farm is the quarter section with about 120 acres irrigable and 40 acres dry land. These farmers are located in 11 large irrigation projects but there are in addition 391 smaller projects capable of irrigating about 57,750 acres.

Irrigation farming has a peculiar place in the scheme of rehabilitation. Thus it became necessary to make a careful analysis of irrigation farming for the guidance of administrative officers and to indicate to prospective settlers on established or new irrigation projects the major factors affecting success in this more intensive use of land resources.

This study was extended in 1941 to provide information which might assist the Committee appointed to investigate the feasibility of the development of the St. Mary's and Milk Rivers for irrigation purposes and considerable data were made available to the Committee. A final report on this study is now in progress.

Land Tenure.—Problems of land tenure have been increasing in Western Canada. What are the advantages of ownership? What are the advantages of tenant-farming? What are the disadvantages of and what are desirable leasehold agreements? How may landlord-tenant relations be improved? These are some of the problems involved in a study of land tenure undertaken in Saskatchewan. In this project, the Farm Management Department at the University of Saskatchewan assumed direction of the collection and analysis of the information, which has been collected in at least six representative areas—Lashburn-Paynton in the northwest, Melfort and Pleasantdale in the northeast, Churchbridge-Saltcoats in the east-central section, Balgonie-Qu'Appelle and Wilcox in the south central area. Each is representative of a particular type of farming and is representative of different soil types and presents special problems in land tenure.

A little less than two thirds of the leases used by the farmers in the Saltcoats-Churchbridge survey were held under written contracts. In the Lashburn-Paynton area, 34 out of 58 leases were written and 24 were oral. Some oral leases in this area were leases for which written contracts had originally been signed but the original agreement was no longer in force. In the Saltcoats-Churchbridge area, 16 leases were for one year, 9 for two years, 27 for three years, 7 for more than three years and 30 supplied no information. In the Lashburn-Paynton area, seven were for one year, six for two years, 19 for three years and no information was reported in 24 cases.

Very few of the leases used by farmers seemed to contain adequate protective clauses for either the landlord or tenant.

The most common rental agreement was that in which the lessor supplied all or a portion of the real estate and the tenant supplied the working capital including power, equipment and live stock. In 50 out of 89 leases in the Churchbridge area, the lessor supplied only the land, in 21 leases the landlord supplied land and buildings and in 17 cases the lessor supplied all the land and a part of the buildings. In the Lashburn-Paynton area, 36 out of 58 landlords supplied only the land, 10 supplied land and all the buildings, 11 supplied land and part of the buildings. Only three cash leases were reported in the first year in which the study was conducted. The one-third crop share lease was by far the most common share renting agreement. The half-share crop lease was second in importance.

Land Settlement.—In 1941 two projects in land settlement were undertaken, one in the Albertville-Garrick area north and east of Prince Albert and the other in the Winfield-Sangudo area, west and south of Edmonton. There were several objects in view when inaugurating these studies; one was to obtain information on the progress of settlers who had left the drought area; the second was to obtain information on settlers' problems and the rate of progress; a third was to determine in so far as possible, the suitability of land newly taken up for settlement. In 1942, two new areas were included in this project, one embracing the Aylsham-Carrot River district, the Crooked Creek district, the Bjorkdale-Carragana district and the Preeceville-Lintlaw area in the northeastern section of Saskatchewan and the other comprising the Big River, Loon Lake, Meadow Lake and Goodsoil districts in the northwest. In Alberta, personal interviews were made with farmers in the Peace River country in the neighbourhood of Bear Lake, Wapiti, Debolt, Lynburn, Hines Creek and Notikewin. Some results of the Albertville-Garrick study may be used to indicate pertinent information applicable. Of the farm operators, 63·8 per cent were farmers' sons, 14·8 per cent had been hired men on farms before locating, 13·2 per cent had been labourers and clerks, professional men, lumbermen, trappers, soldiers, sailors and mechanics made up the balance. Sixty-eight per cent of the land was obtained by homestead; 21 per cent was purchased. Analysis of the birth places of operators shows that 41·4 per cent were born in Canada; 14·5 per cent in the United States, 6·3 in England and Wales, 3·3 per cent in Scotland, 1·6 in Ireland and 32·9 per cent were of European origin.

The average progress of settlers in breaking and clearing was 77·1 acres at the end of 14 years or 5·5 acres per year. It required 14 years to reach the point where a family became self-supporting at a modest level of living.

Level of Living in Northern Pioneer Farms.—In all of the projects conducted in recent years, data on cash costs of living have been obtained. In the northeastern pioneer section of Saskatchewan, a study of the level of living was made. A study of this type is necessary not only because of the factual data on costs of living but it has significance in setting up budgets whereby the distinctions between land classes may be made. In other words, land will be utilized in different ways depending upon the level of living possible as a result of its use. This type of survey is to be extended. It brings into the analysis of land use, sociological factors not hitherto considered. Included in this study was an analysis of the adequacy of rural diets.

Other Research.—Other projects carried on are the following: Debt carrying capacity of land in Saskatchewan; changes in farm income and indebtedness in Saskatchewan; assistance to the Department of Farm Management, University of Saskatchewan in a study of custom rates for power equipment in Saskatchewan. Another wartime service has been assistance to the Alberta Department of Agriculture in establishing farm labour standards essential in determining farmers' labour requirements as a basis for allocation of labour supply under wartime conditions.

This brief summary of economic research indicates clearly that along with the development of administrative policies of rehabilitation, there has been a growing recognition of the necessity of factual data as a basis for public policy and this is just one phase of the research program.

Water Development under the Prairie Farm Rehabilitation Act

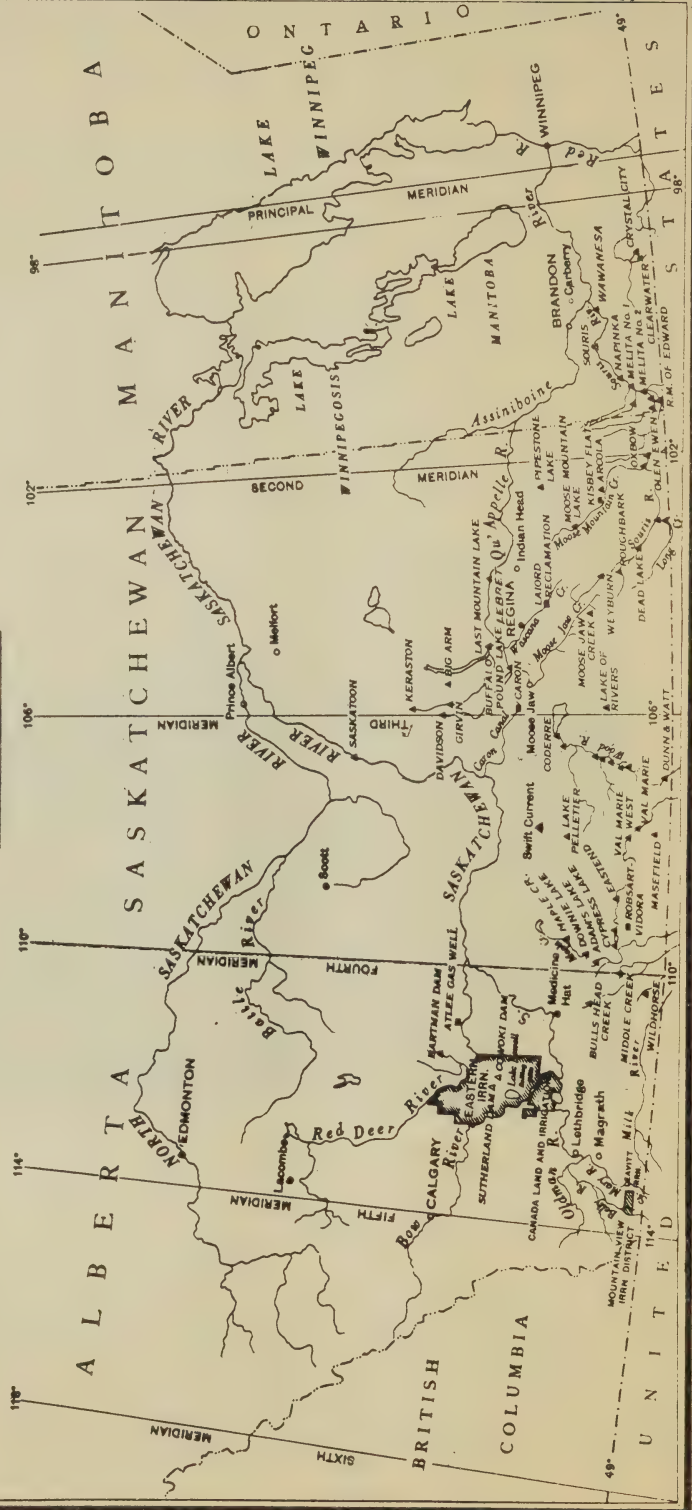
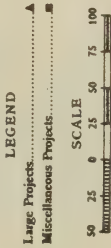
The P.F.R.A. water development program has resulted in appreciable benefits to agriculture on the Canadian prairies. The main benefit is to the live stock industry by creating or improving water facilities on pasture and feed lots and by the production of reserve supplies of forage grown under irrigation. Improved water supply has also had a beneficial effect on farms generally, both as regards water for domestic purposes and for the irrigation of gardens and orchards. That these benefits have been secured is clearly evident from the fact that in thousands of localities there is now sufficient water where formerly the supply was inadequate. Further, in the eight years' work on water development, information and experience have been secured which will prove invaluable in formulating future programs for the increase and stabilization of production on the agricultural lands in the prairies.



FIG. 12.—An engineer and rodman surveying a site for a farmer's dam. This service is a main contribution of P.F.R.A. in providing water supplies on prairie farms.

Water development carried out under the P.F.R.A. consists of large and small projects. The large projects include storage and irrigation works on the larger rivers and streams and are intended to serve community needs and provide for rehabilitation on a community scale. Small projects consist of dugouts, stock-watering dams and irrigation works. These are developed for the purpose of providing water on individual farms from the smaller streams and local run-off. Individual projects are supplemented in some areas by small community projects which are usually operated by the municipality. The larger projects are usually constructed by contract and the total cost paid from the P.F.R.A. vote. In the case of small water development projects financial

LARGE WATER DEVELOPMENT PROJECTS UNDER THE PRAIRIE FARM REHABILITATION ACT To End of March, 1942



assistance is provided under P.F.R.A. on a self-help basis to cover only part of the construction costs, and applicants are responsible for the construction of the works. Financial assistance is payable to applicants in the case of small projects only when the works are completed to conform to provincial water rights regulations and to plans and specifications approved by the supervising engineer.

WORK ACCOMPLISHED UNDER P.F.R.A. WATER DEVELOPMENT

From the inauguration of the program in 1935 to March 31, 1943, the following water development work has been accomplished.

Large Projects—

1. To maintain a water supply to over 50,000 acres of irrigated land in existing projects, repairs have been made to three large irrigation systems in Alberta, namely, the Canada Land and Irrigation Company, the Magrath Irrigation District and the Mountain View Irrigation District.

2. Irrigation works have been improved in the Eastern Irrigation District involving the construction of two reservoirs to store 22,000 acre-feet of water and an extension of the irrigable lands in the district.

3. The creation of 18 new irrigation projects covering when completed an aggregate of approximately 110,000 acres of irrigated land and involving the construction of 36 dams to provide storage of some 365,000 acre-feet of water.

4. The construction of 37 stockwatering dams with a total capacity of some 15,000 acre-feet.

5. Work has been done on nine projects of a miscellaneous character including the drilling of an experimental gas well at Atlee, Alberta, two large drainage projects, and other projects.

In all, work has been completed or well advanced on 64 separate large projects at a cost which when completed will be in excess of \$6,000,000. The location of large P.F.R.A. water development projects is indicated on the map in Appendix III.

Small Projects including Municipal and other Community Projects—

Individual farmers have been assisted in the construction of 14,649 water storage dugouts, 3,889 stockwatering dams, and 935 irrigation projects. In the aggregate, these projects provide water storage of 100,000 acre-feet and irrigation for some 40,000 acres. The total financial assistance paid on these projects to March 31, 1943, amounts to \$2,124,772.30. The number and type of small water development projects constructed in each year since 1935 and the financial assistance paid on these projects, is indicated in Appendix II of this report.

TYPE OF DEVELOPMENT

The type of water development most adaptable to the different sections of the prairies varies with the available ground water and the surface water supplies, and also with topography, precipitation and soil conditions. There are many large areas topographically suited for irrigation but which are located where the natural precipitation, subject to cycles of wet and dry years, is insufficient for permanent agriculture. When these areas are sufficiently close to the permanent streams or those which flow from the mountains and foothills, extensive irrigation is feasible. In such cases the diversion of the streams is the solution of the water supply problem, not only for irrigation purposes but for domestic, municipal and other purposes as well. However, 90 per cent of the prairie grass lands cannot be served with water from the more permanent streams and depend for their supply either from the less permanent streams or from local ground water or surface water supplies. It is in

these larger areas remote from the permanent streams where the development of water supplies presents the most difficult problem. As a result of low precipitation and high summer temperatures the majority of the prairie streams tend to become dry or nearly so during the summer. For the same reason many shallow lakes or sloughs which hold water in the spring go dry in the summer. To store the spring run-off for summer use, therefore, it is necessary to conserve water for domestic, municipal and agricultural purposes. In the more rolling areas, where the local run-off is confined to smaller streams, considerable quantities of water can be stored for summer use by the construction of small dams. However, in much larger areas of comparatively flat lands, excavations or dugouts, made in the ground at suitable locations, are the best means of conserving run-off.

Dugouts—

A typical dugout to hold a year's supply of water generally measures 160 feet in length, about 60 feet in width on top and from 10 to 12 feet in depth. The side slopes depend somewhat on the type of soil excavated and the excavation equipment available, but generally they are 2 to 1 along the sides and 4 to 1 at the ends. A dugout of the foregoing dimensions would have a capacity of from 350,000 to 390,000 Imperial gallons or, allowing for evaporation and seepage losses at approximately 3 feet in depth over the surface, an effective capacity of from 200,000 to 240,000 Imperial gallons.



FIG. 13.—Range cattle drinking from a dugout in southeastern Alberta. The depth of water in this project was 9 feet when the above photograph was taken October 1st, 1943, although there had been no runoff and scarcely any rain since early spring.

Dugouts may be excavated by horse-drawn, tractor-drawn or heavy earth-moving equipment. They require no engineering skill other than the judicious selection of a site in pervious soil where water is likely to collect. Since the drainage area necessary to provide run-off to fill an average dugout is not very large, say from 35 to 50 acres, and since there is usually a reasonably wide choice of suitable locations within a given drainage area, it is generally possible to locate dugouts close to the point of maximum use, that is, close to buildings,

gardens or at convenient points in pasture areas. This feature alone makes the dugout a most suitable water supply for individual farms and accounts for the fact that of the 19,785 small water developments completed by the P.F.R.A., about 75 per cent have been dugouts.

While the usual purpose of the dugout is stockwatering, it can also be used for household purposes and to irrigate gardens. In order to make dugout water suitable for domestic use, the installation of sand and gravel filters connecting the dugout with shallow wells is necessary, and in order to use the water for irrigation it is generally necessary to pump. The widespread use of dugouts on prairie farms has greatly improved living conditions and helped to solve production problems where water from wells is either impossible to obtain or unsuitable, or too costly to develop. In this latter connection, the experience of a group of farmers in the Red River plains will show the necessity of dugouts even in those areas where underground supplies are available. These farmers, who were engaged largely in hog production, found that local well water was unsuitable by reason of the high accumulation of dissolved salts. This situation was relieved by the excavation of dugouts.

Since a dugout provides storage entirely below ground level, there is danger of the water becoming stagnant. It is for this reason that adequate depth is so highly important where a year round supply is needed. Another problem in connection with dugouts results from soil being washed into the hole. This may be overcome by seeding the run-off area to grass. Probably the main disadvantage of the dugout is the fact that its storage capacity is determined solely by the amount of earth excavated. This generally limits the use of dugouts to household purposes, stockwatering and small garden irrigation.

Dams—

Reservoirs created by dams constructed under P.F.R.A. range in capacity all the way from 2 or 3 acre-feet in the case of individual small projects, to as much as 85,000 acre-feet in the case of larger projects and are used to store water for irrigation, municipal, domestic and stockwatering purposes. In many cases where the drainage area is large, both spillway and control gate structures have been provided, while in a great many cases where the spring flow is not too great and the overflow can be released safely through some natural draw or depression back to the stream, spillway structures have not been built. In some cases where the drainage area is small, no provision has been made to spill surplus water except through the control gate structure, and in exceptional cases where the conservation of water does not affect the drainage area below, no outlet structures have been provided.

Most of the P.F.R.A. dams so far constructed are the earthfill type and are essentially broad embankments across valleys or streams properly compacted and riprapped to withstand water pressure and erosion due to wave action. A typical small earthfill dam would measure something like 100 feet through at the base and from 20 to 25 feet in height with gently sloping sides. The top width may be some 10 to 20 feet, and at an elevation of from 3 to 5 feet above the full supply level of the pond. Dams for use on individual farms are usually built of sufficient height to impound water to a depth of from 10 to 20 feet. On the larger projects where a greater quantity of water is required in connection with extensive irrigation, earth dams at a height of from 50 to 75 feet have been constructed. All earth dams are protected on the upstream face by riprap, generally consisting of large rock embedded in gravel and sand. This is essential in order to prevent erosion of the face by wave action.

An essential feature where a dam is on a live stream is the spillway which, by permitting the flow in excess of the storage capacity to pass safely around, through or over the dam, acts as a safety valve during periods of high flow. To provide the necessary safety factor for the dam, the spillway must be designed

and constructed of sufficient capacity to carry the maximum discharge from the drainage area. A satisfactory spillway may consist of some natural depression sufficiently below the crest elevation of the dam to carry the maximum discharge well below that elevation, or where there are no natural spillway facilities, a structure either of timber or concrete to pass the excess flow at either end of the dam.

Earth dams are subject to failure due to insufficient spillway capacity, and in many cases such dams have been over-topped and breached through failure to remove ice and other debris from the spillway before the spring run-off occurs. On the larger P.F.R.A. dams the spillways are built of concrete in the form of a chute from the full supply level of the reservoirs to the streams below and, in some cases, gates or stoplogs regulate the flow. On some of the larger streams where foundation conditions are suitable and the flood discharge is great, it has been more economical to construct the dams of either concrete or rock and timber, in which case excess water is disposed of over the full crest of the dam.

Stockwater Reservoirs—

Reservoirs built for any purpose whatsoever serve to supply water for stock in the adjacent areas, but many small reservoirs, particularly throughout the grazing areas, have been built specifically for stockwatering purposes. There are two types of development which have been adopted for stockwatering purposes in given areas. The first is to construct a fairly large reservoir near the head of the drainage basin, from which water is continually released during the summer or other dry periods to supply stockwater facilities along the full length of the stream below. The other is to build a large number of smaller reservoirs distributed throughout the area at points where the topography is such and the water supply sufficient to store small quantities at convenient locations. Where the water supply is sufficient and the facilities exist, the headwater control provides a means of supplying large areas with stockwater. On the other hand, there are very large areas which can only be served by a system of smaller developments widely distributed throughout the grazing lands.

Irrigation Reservoirs—

To properly regulate the stream flow and distribute water most beneficially for irrigation, large reservoirs are desirable in connection with all streams and are essential in the case of prairie streams where the available supply is limited. Irrigation reservoirs are of two classes, depending on the function they perform, namely, primary and secondary. Primary reservoirs are those located directly on the streams and their function is to hold back or conserve, for use later on, as much as possible of the flood discharge and winter flow. They are generally located at considerable distances from the irrigable lands but are not so well suited to deliver water quickly to the lands in order to take care of the peak irrigation demands. Secondary reservoirs are those which are located generally off the stream and as close as possible to the irrigable lands. They are mainly for the purpose of supplying water in volume, as demanded from time to time through the system by the water users. They function first as a balance to the system by taking care immediately of the high irrigation demands, and secondly as a protection to the main canal of the system by building up a reserve supply which can be used in case of interruptions of flow in the canal. *In the case of larger projects, where, in order to command any considerable area of land, it is generally necessary to bring the water entirely out of the valley to the bench lands, the possibility of conveying water by gravity will depend firstly upon the depth of the stream below the lands to be irrigated, and secondly on the slope or fall of the stream itself.* To take an extreme example, if the river were 100 feet below the irrigable lands and the slope or fall, say, 4 feet to the mile, it

would require a canal of over 25 miles to bring the water from the river to the irrigable lands. In the case of such a development, secondary reservoirs close to the irrigable lands are of great value to the system.

So far the P.F.R.A. has confined its development to the valley lands which are at no great height above river level. In this way long canals have been avoided. However, the amount of land which can be irrigated this way is very limited and is generally inferior to the bench lands. For the development of any further extensive areas, it will be necessary to extend irrigation to the bench lands.

Flood Irrigation—

In certain locations along some of the smaller streams where hay flats only require to be flooded once during the spring, irrigation is accomplished by building a small diversion dam and system of dykes to hold water until such time as the soil is entirely wetted, after which the water is drained back to the stream. By this means, known as flood irrigation, it is possible to augment the amount of moisture in the soil at the beginning of the growing season and in this way improve the yield of hay. It is, however, not a satisfactory method of irrigation for community projects because individuals have no control of the water supply.

Pump Irrigation—

There are considerable areas, particularly along the river valleys, where pump irrigation is the only development possible. A gasoline or diesel power plant makes the cost of pumping more than 25 to 30 feet prohibitive, but by using natural gas as fuel the height can be increased and by employing water power, there is practically no limit to the height to which water may be pumped for irrigation. So far, pumping projects under P.F.R.A. have been confined to the smaller areas such as gardens, but there are many opportunities to extend this type of water development in the future.



FIG. 14.—Some 14,500 dugouts and 5,500 individual stock-watering dams have been completed under P.F.R.A. in the three prairie provinces. These projects store water for domestic use from the surface runoff of snow and rain.

DISTRIBUTION OF PROJECTS

The distribution of water development projects constructed under P.F.R.A. reflects to some extent regional differences in the type of agriculture. To date, some 18,538 small dams and dugouts have been constructed under P.F.R.A. Of these, 5,648 are in southwestern Manitoba. In this area, however, the topography is such that reservoirs by the construction of dams are not often feasible and dugouts have been the best means of providing a water supply. Of the 5,648 small projects in this area 94 per cent or 5,309 are dugouts and 6 per cent or 339 are dams. Of the 339 dams constructed, only 18 of them have been used for irrigation purposes.

In Saskatchewan, 11,857 small projects have been constructed to date. Of these 73 per cent or 8,656 are dugouts, 22 per cent or 2,608 are stockwatering dams, and 5 per cent or 593 are irrigation projects.

In Alberta where 1,968 small projects have been constructed, 36 per cent or 708 are dugouts, 49 per cent or 964 are stockwatering dams, and 15 per cent or 295 are irrigation projects.

The high percentage of dugouts in Manitoba reflects to some extent the predominance of live stock production on farms in that province, while the progressive westward increase in stockwatering dams corresponds to a similar increase in range production. The greater number of small projects in the western regions is due partly to less suitable climatic conditions for dry land farming in southwestern Saskatchewan and southern Alberta.

The distribution of the larger P.F.R.A. water development projects has been governed largely by topographic conditions and accessible water supplies. Further governing factors are suitable lands to irrigate, having regard to soil and local topography, and also local climatic conditions such as prevailing winds and precipitation. A fundamental factor affecting economical irrigation is that benefit to crops is inversely proportional to the amount of precipitation available to crops after allowing for evaporation. In many parts of the Prairie Provinces where the average effective precipitation is sufficient for the economical production of grain crops as in Manitoba and parts of the foothills, increased yields of ordinary crops which would result from the construction of irrigation works might not justify the cost of installing them. In the semi-arid to arid regions of southern Saskatchewan and southern Alberta, irrigation offers decided advantages and in some districts may be essential to any economical crop production whatever.

The suitability of semi-arid and arid regions for irrigated crop production is enhanced by the prevailing low cost of land in such regions. Where such conditions obtain, a charge for water may be substituted for a charge for land as items in the cost of producing crops which might not justify both charges. A further advantage of irrigation farming in semi-arid or arid regions is that cultural operations are unlikely to be interfered with by wet weather.

Regarding the influence of topography and access of the water supply on the distribution of the larger projects certain broad groupings may be made. These groupings include development in relation to the foothills, the Cypress Hills, the Qu'Appelle, Souris and Wood Rivers and a group of miscellaneous projects.

(See Appendix III).

Mountain and Foothill Streams

Melting snow in the Rocky Mountains provides the largest and most reliable source of water supply for the Canadian prairies. At points where rivers emerge from the eastern slopes of the Rockies or foothills, it is possible to divert water by gravity canals for the irrigation of lands further to the east. This condition has made possible considerable large scale developments in southern Alberta, some of which have been constructed and others surveyed.

Prior to the inauguration of the P.F.R.A. program, development had taken place on 12 large irrigation projects in southern Alberta, all drawing water from the mountain and foothill streams. These projects covered an aggregate of about 680,000 acres of irrigable land of which about 400,000 acres were actually irrigated. Five of these projects, the C.P.R. Lethbridge Section, the Lethbridge Northern, Taber, Magrath and Raymond Irrigation Districts are partly devoted to beet production for the important sugar beet industry in southern Alberta. The remaining projects including the C.P.R. Western Section, the Eastern, United, New West, Mountain View and Little Bow Districts and also the Canada Land and Irrigation Company, provide for mixed farming and forage crop production under irrigation.

In connection with some of the foregoing projects, a considerable amount of water development work has been conducted under P.F.R.A. In the case of two of these projects, namely the Canada Land and Irrigation Company and the Magrath Irrigation District, assistance has been provided for repairs and extension to existing works to ensure continued delivery of water to a large portion of the lands in these districts. In the Eastern Irrigation District, existing works have been repaired and enlarged to provide for additional irrigation of some 27,280 acres including the Rolling Hills project described on page 44 of this report. In the Leavitt and Mountain View Irrigation Districts, the completion of works previously commenced has stimulated irrigation development on some 10,000 acres. Rehabilitation of these projects, the continual operation of which had been rendered precarious by recent conditions of economic depression has prevented considerable loss and possible hardship on the part of many farmers settled on the irrigable lands. A large amount of exploratory work including surveys and test borings has been conducted with a view to still greater utilization of the mountain foothill streams.

Cypress Hills

The Cypress Hills extend easterly from just south of Medicine Hat in Alberta for 100 miles into southwestern Saskatchewan and form a prominent physiographic feature of the provinces. They range from 3,000 to 4,000 feet above sea level and from 1,000 to 1,500 feet above the surrounding country. Rainfall in these hills, because of the elevation, is greater than in the surrounding territory. The average annual precipitation is as high as 21 inches as compared with 11 inches to 17 inches on the adjacent prairies. As a result of this condition, the intensity of run-off from the hills is greater than from areas of equal size in the lower prairie areas. Some of the Cypress Hills streams, notably the Frenchman River and Battle Creek and tributaries, flow south to the Missouri basin. Others, including Swift Current Creek, join the South Saskatchewan while a few, like Maple Creek, empty into lakes which have no outlet.

The conditions as outlined above have made possible and desirable a considerable amount of water development in the Cypress Hills region. Most of this region being typical ranching country, it stands to benefit from water development for stockwatering and the irrigation of forage crops. Indeed, prior to the inauguration of the P.F.R.A. program, many stockwatering dams and some irrigation projects had been constructed by private ranching interests along the streams. Full utilization of these water resources was beyond the means of private interests.

In addition to a great many small projects which have been developed in the Cypress Hills area, a number of large developments have also been undertaken by P.F.R.A. as a rehabilitation measure to stabilize live stock production in the area.

Eleven large P.F.R.A. projects utilize water from the Cypress Hills. The largest of these is the Cypress Lake reservoir in Saskatchewan in which is collected the run-off of Battle Creek and tributaries of the Frenchman River.

The reservoir has a capacity of some 80,000 acre-feet. This storage has been effected by the construction of two large dams, one at the eastern outlet of the lake into the Frenchman River, and one at the western end to prevent overflow to Battle Creek. The reservoir provides reserve supplies of water for irrigation projects along the Frenchman River and Battle Creek and also maintains a stream flow for stockwatering purposes along these streams. The Frenchman River and Battle Creek are international streams subject to provisions of an International Treaty by which an equal division of the flow between United States and Canada is required. In addition to conserving water for irrigation and stockwatering purposes in Canada, therefore, Cypress Lake storage will be used to regulate the streams as required under the Treaty.

Irrigation projects have been constructed along the Frenchman River at Eastend, West Val Marie and Val Marie all in Saskatchewan. Other irrigation developments are contemplated for Battle Creek. In each of the existing projects, a dam across the Frenchman River impounds water which is conveyed to the river flats by short canals. At West Val Marie a considerable acreage at too high a level to be irrigated by gravity, will receive water from the reservoir by pumping. Each of the foregoing storage reservoirs can be replenished from Cypress Lake. The total irrigable area of these projects is 14,861 acres, most of which is used to produce forage crops for ranch use. With the exception of the land under the pump at West Val Marie, these projects are now in operation.

To the southwest of Cypress Lake, provision has been made to irrigate some 3,000 acres of land in the Consul-Vidora district. The main canal from Cypress Lake has been built by P.F.R.A. but so far, distribution canals have not been constructed.

Streams flowing north from the Cypress Hills through the Maple Creek district of Saskatchewan have been utilized in the development of the Maple Creek Irrigation Project covering some 6,000 acres of irrigable land. The development of this project for the production of forage crops has involved the construction of the Downie Lake, Junction and Tenaille Lake reservoirs and also a considerable number of miles of main and distribution canals. This project is now in operation.

At the western end of the Cypress Hills in Alberta, three P.F.R.A. stockwatering and irrigation projects have been constructed, one on Sage Creek which will serve some 3,600 acres of irrigable land, another on Bullshead Creek serving 800 acres of irrigable land and another on Seven Persons Creek which for the present will be used only for stockwatering purposes, but will eventually be incorporated in the system of canals and reservoirs from the St. Mary River and known as the St. Mary-Milk River Water Development Project. In connection with the Sage Creek development, known as the Wildhorse Storage, the dam was breached in 1939 and has not yet been repaired, so that no irrigable lands have yet been irrigated.

Near Swift Current, Saskatchewan, the most ambitious single irrigation project yet undertaken under the P.F.R.A., is now under construction. Water for some 25,000 acres of dry lands to the east of Swift Current is now being stored in three reservoirs. The main or primary storage has been created on Swift Current Creek near Duncairn by the construction of an earthfill dam with a maximum height of 66 feet. The storage capacity at full supply level is about 85,000 acre-feet. Additional primary storage has been created on a branch of Swift Current Creek at Lac Pelletier, and secondary storage on Rush Lake Creek near Highfield. The capacity of the Lac Pelletier storage is 3,350 acre-feet and of the Highfield storage about 10,000 acre-feet. By the fall of 1942, all of the storage had been completed and considerable progress had been made in the construction of drainage and supply canals.

Other projects constructed in the Cypress Hills are at the headwaters of Battle and Lodge Creeks and, in the aggregate, the projects above outlined provide for the irrigation of nearly 56,000 acres of land and for storage of some 239,000 acre-feet of water. Of the irrigable land for which water has now been made available, some 25,000 acres are now being irrigated.

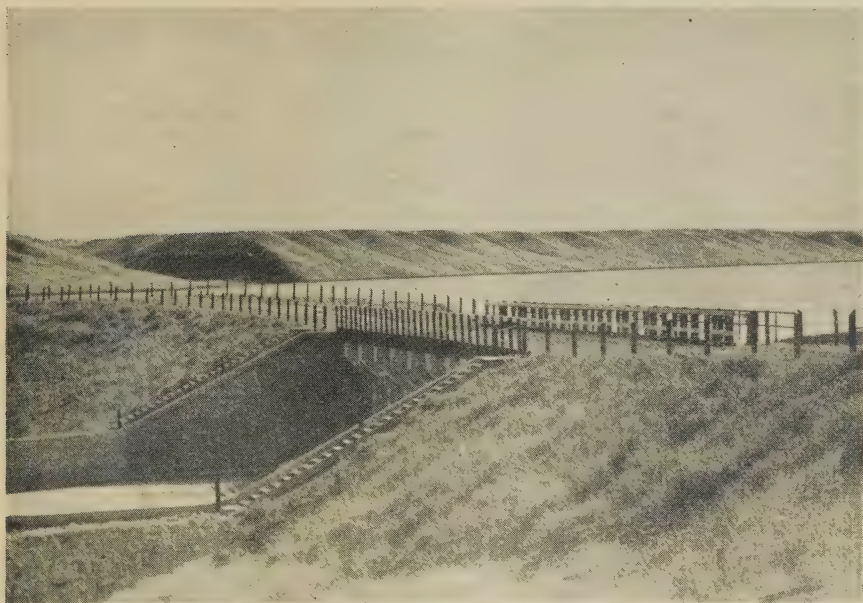


FIG. 15.—The Duncairn dam on the Swift Current creek, southwest of the city of Swift Current, has created a reservoir with a capacity of 85,000 acre feet. This reservoir will supply water for the Swift Current irrigation project.

Souris River—

The Souris River is a prairie stream which rises in the Yellow Grass marshes to the north of Weyburn, Saskatchewan. From there it flows southwesterly into the United States where it makes a loop and returns to Canada in southwestern Manitoba and eventually joins the Assiniboine River some distance southeast of Brandon. With a view to conserving some of the spring flow of this stream for stockwatering and other purposes during the dry seasons, a number of P.F.R.A. projects have been constructed both in Saskatchewan and Manitoba. Projects in the Saskatchewan section of the Souris River drainage basin include the Souris River—Estevan Irrigation Project covering 3,900 acres of the river flats with storage reservoirs at Dead Lake on the Souris River and at Roughbark Creek. Further reservoirs have been constructed in the drainage area, one just below the town of Weyburn to conserve water for urban uses, another at Moose Mountain Lake to store water for irrigation purposes and two small dams on Long Creek to conserve water for the town of Estevan. In Manitoba, stockwatering dams have been built on the Souris River at Melita, Napinka, Wawanesa and Hartney. These dams make it possible to maintain a flow of water during dry seasons for the benefit of stock raisers along the river. The total storage capacity so far created on the Souris River is about 18,700 acre-feet including such tributaries as Roughbark Creek, Long Creek, Moose Mountain Lake in Saskatchewan and Gainsborough Creek, Antler Creek and Graham Creek in Manitoba.

Wood River—

On the Wood River and its tributaries in south central Saskatchewan, eight stockwatering dams impounding a total of 4,923 acre-feet have been constructed to maintain stream flow for stockwatering purposes. As these streams sometimes become dry in summer, this development is of benefit to stock raisers in the district.

Qu'Appelle River—

There are extensive river flats along the Qu'Appelle valley between Buffalo Pound Lake and the Assiniboine River which can be irrigated either by gravity diversions or by pumping. Temporary dams now in operation have been successful in flooding hay lands, and a number of pumping projects have been in operation for a few years. The development of storage, however, will create the facilities to greatly extend irrigation along the valley. P.F.R.A. developments so far completed include storage dams to control water at Buffalo Pound Lake, Last Mountain Lake, both of which empty into the Qu'Appelle River, and at Round Lake, Crooked Lake and Echo Lake, all in the Qu'Appelle valley. In connection with the Buffalo Pound Lake reservoir, water is diverted from Moose Jaw Creek to the lake and from there is released down the Qu'Appelle River as required for whatsoever purpose. Between Buffalo Pound Lake and Lumsden are considerable areas which can be served by a gravity canal with deliveries to individual parcels. The remainder of the valley lands are too flat to irrigate extensively by gravity diversions, but large areas can be served by pumping plants for flood irrigation. The creation of storage will make it possible to irrigate a large portion of the lands in the valley.

MISCELLANEOUS PROJECTS

A number of large P.F.R.A. projects do not fit readily into physiographical groups. These are all tabulated in Appendix III. The following projects, however, may prove of more than special interest.

Caron Water Storage—

The primary object of this project is to supply water from the South Saskatchewan River to the City of Moose Jaw for which city there is no adequate supply closer than the South Saskatchewan River. Water is pumped from the South Saskatchewan River at a point some 10 miles south of Riverhurst, Saskatchewan, to a nearby height of land between the South Saskatchewan and Qu'Appelle Rivers. To reach this height of land the water is pumped through a 24-inch pipeline for a distance of 3,900 feet and to a height of 310 feet above the river level. From this height of land the water is conveyed by gravity canal along Thunder Creek to a depression near Caron, Saskatchewan, whence it is pumped to Moose Jaw, some 15 miles distant, through a municipal pipeline from Sandy Creek to the city.

Atlee Gas Well—

Along the bottom of many of the river valleys there are river flats suitable for irrigation. In some cases where the streams are small such river flats have been irrigated by gravity, as already described. In most cases, however, the cost of diversion works is prohibitive and the possibility of pumping water to the flats merits consideration. For the latter methods, some cheap form of power is essential. In this connection, the subterranean supplies of natural gas which exist in certain areas in Alberta present some possibilities for the operation of pumping plants. To determine the feasibility of so utilizing these natural gas supplies, a gas well has been drilled under the P.F.R.A. at Atlee, Alberta. It was found that adequate supplies of gas for irrigation were available at a depth of 1,300 feet. This supply has been used by a number of individuals to pump water in a small way for irrigation, but so far the greatest possible use has not been made of the available supply of gas.

PROBABLE FUTURE WATER DEVELOPMENTS IN THE PRAIRIE PROVINCES

It is of course not possible to predict the future course of P.F.R.A. water development work. Certain projects are under construction and are likely to be completed; others already completed are capable of extension. The entire field has not yet been completely surveyed, but certain surveys and investigations conducted by the P.F.R.A. water development branch utilizing information previously secured by the Dominion Water Power Reclamation Service may give some indication of irrigation possibilities. The total known acreage of irrigable land on the Canadian prairies is approximately 3,000,000 acres, of which some 850,000 acres are now served by irrigation works. Of the remaining 2,150,000 acres susceptible to irrigation, P.F.R.A. surveys and investigations have covered more than 1,877,000 acres in 64 proposed large projects. In addition, 30 large storage projects are under consideration. Community projects likely to be undertaken in the near future number 199, and some 7,480 small projects have been investigated as of March 31, 1943. Of the large projects under consideration, the more extensive are the North Saskatchewan and the St. Mary-Milk River developments.

North Saskatchewan Irrigation Project—

This is a proposal originally made by the late William Pearce of Calgary, Alberta, to utilize the flow of the North Saskatchewan, Clearwater and Red Deer Rivers, not for irrigation in the sense that lands are irrigated on the present projects in Alberta, but rather to distribute the available water supply by natural and artificial channels, where necessary, throughout a very extensive area north of the Red Deer River in Alberta and in Saskatchewan primarily for the development of the live stock industry.

The main obstacles as visualized by Mr. Peterson is the fact that Buffalo Lake, the main reservoir proposed, was too low to command all but a small portion of the area which it was intended to serve. It was determined, therefore, that if the diversions could be made to Sullivan Lake instead of Buffalo Lake, not only could more water be stored than in Buffalo Lake but storage water could be made available to extensive areas much above the elevation of Buffalo Lake. From surveys made in connection with the Sullivan Lake alternative, it was estimated that the cost to irrigate 1,411,000 acres would be something like \$105,600,000, or at the rate of \$74.89 per acre.

While the effect of the high estimated cost of construction was to temporarily kill the project, it was considered that the estimates made did not do justice to the proposal in that only one of the existing possibilities was examined. The P.F.R.A. therefore, are completing further investigations with a view to possible future development if and when circumstances might warrant.

St. Mary-Milk River Water Development—

The purpose of this project is to extend and enlarge the canal systems of the Alberta Railway and Irrigation Company to some 345,000 acres of additional lands to the south and east of the present Lethbridge-Coaldale district. Partly to protect Canada's right to beneficial use of the streams and partly to provide additional water for new lands as well as lands now irrigated, there has in recent years developed a widespread and strong demand by irrigation interests in southern Alberta for the construction of this project. These demands led to the appointment of a committee by the Dominion Government which, in co-operation with a committee designated by the Alberta Provincial Government, were instructed to make a study of all aspects of the proposal and present a comprehensive report for transmission to the Governor in Council. This report has since been published. General plans, designs and cost estimates of this development have already been prepared by engineers under the P.F.R.A. from extensive surveys and studies made by them. This work is still in progress.

APPENDICES

Average value of production per year—

| | | | | | | | | |
|-------------------------|-------------|------------|-------------|------------|-------------|------------|-------------|-------------|
| Wheat..... | 173,026,993 | 48,578,319 | 90,810,034 | 49,492,737 | 80,031,386 | 60,275,606 | 343,918,414 | 158,346,663 |
| Oats..... | 37,205,021 | 7,756,569 | 24,128,711 | 10,787,380 | 34,834,367 | 21,944,138 | 96,168,100 | 40,488,087 |
| Barley..... | 9,094,883 | 2,285,304 | 11,758,987 | 5,261,981 | 16,162,956 | 11,123,301 | 37,016,825 | 18,670,486 |
| Total..... | 219,326,897 | 58,620,192 | 126,697,732 | 65,542,098 | 131,078,703 | 93,343,045 | 477,103,339 | 217,505,236 |
| Average value per acre— | | | | | | | | |
| Wheat..... | 14.98 | 4.03 | 16.38 | 7.75 | 16.88 | 9.70 | 15.75 | 6.42 |
| Oats..... | 10.35 | 2.47 | 12.01 | 5.05 | 11.64 | 6.40 | 11.18 | 4.65 |
| Barley..... | 11.36 | 2.66 | 13.14 | 5.25 | 12.03 | 6.84 | 12.18 | 5.35 |
| Average price per bu.— | | | | | | | | |
| Wheat..... | .908 | .530 | .964 | .550 | .884 | .561 | .916 | .549 |
| Oats..... | .343 | .182 | .363 | .204 | .357 | .213 | .353 | .204 |
| Barley..... | .490 | .242 | .513 | .285 | .4937 | .308 | .499 | .291 |

APPENDIX II

SMALL P.F.R.A. WATER DEVELOPMENT PROJECTS

NUMBER AND TYPE OF SMALL PROJECTS CONSTRUCTED AND AMOUNT OF FINANCIAL ASSISTANCE PAID IN EACH OF THE FISCAL YEARS FROM 1935-36 TO 1942-43 INCLUSIVE

| Fiscal Year | Number of Small Projects for which Financial Assistance has been Paid | | | Amount of Financial Assistance Paid for Small Projects | | | | |
|---------------------|---|---------------------|---------------------|--|--------------|---------------------|---------------------|--------------------|
| | Dugouts | Stock-watering Dams | Irrigation Projects | All Small Projects | Dugouts | Stock-watering Dams | Irrigation Projects | All Small Projects |
| 1935-36..... | 49 | 28 | 5 | 82 | 1,558.53 | 2,374.04 | 869.51 | 4,802.03 |
| 1936-37..... | 858 | 465 | 102 | 1,425 | 41,053.44 | 36,022.13 | 17,608.74 | 94,684.31 |
| 1937-38..... | 1,493 | 850 | 215 | 2,558 | 105,293.19 | 83,287.75 | 41,419.06 | 230,000.00 |
| 1938-39..... | 2,745 | 855 | 178 | 3,778 | 283,445.40 | 109,998.08 | 29,493.11 | 418,936.59 |
| 1939-40..... | 1,023 | 193 | 44 | 1,260 | 166,836.34 | 65,785.92 | 6,419.91 | 239,042.17 |
| 1940-41..... | 4,433 | 877 | 232 | 5,542 | 529,350.72 | 86,515.21 | 37,244.38 | 653,110.31 |
| 1941-42..... | 2,773 | 447 | 115 | 3,335 | 288,754.54 | 36,890.14 | 18,987.16 | 344,631.84 |
| 1942-43..... | 1,275 | 174 | 44 | 1,493 | 120,049.61 | 13,755.46 | 5,759.93 | 139,565.00 |
| Total, 8 years..... | 14,649 | 3,889 | 935 | 19,473 | 1,536,341.77 | 430,628.73 | 157,801.80 | 2,124,772.30 |

APPENDIX III LARGE P.F.R.A. WATER DEVELOPMENT PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION IN MANITOBA AS OF MARCH 31, 1943

| No. | Name of Project | Location | Description of Project | Irrigable Area (acres) | Storage Capacity (acre-ft.) | Construction Cost including Land Purchase \$ |
|-----|---|--|--|------------------------|-----------------------------|--|
| 1 | Souris River Development in Manitoba. | | Development of Souris River and tributaries in Manitoba for domestic, municipal and stockwater supply. | | | |
| 1-a | Souris Dam..... | Souris..... | Reconstruction of old dam built in 1911 for stockwatering and domestic use, repaired under P.F.R.A. in 1937. | | 150 | 3,841.00 |
| 1-b | Souris River, Melita Dam No. 1 | Sec. 8-4-26, WPM... | Reinforced concrete overflow dam controlled by stop-logs in the Souris River for stockwatering purposes. Completed in 1937. | 780 | | |
| 1-c | Souris River, Melita Dam No. 2 | Sec. 33-2-27, WPM. | Reinforced concrete overflow dam controlled by stop-logs in the Souris River for stockwatering purposes. Completed in 1937. | 480 | | 11,227.44 |
| 1-d | Souris River, Napinka Dam ... | Napinka..... | Reinforced concrete overflow dam controlled by stop-logs in the Souris River for stockwatering purposes. Completed in 1938. | | 1,000 | 6,709.55 |
| 1-e | Souris River, Wawanesa Dam... | Wawanesa..... | Gravity type overflow weir in the Souris River at the Town of Wawanesa, for stockwatering and other purposes. Completed in 1939. | | 320 | 15,457.25 |
| 1-f | Souris River, Hartney Dam... | Hartney..... | Reinforced concrete overflow dam controlled by stop-logs in the Souris River for stockwatering purposes. Completed in 1941. | | 220 | 10,224.35 |
| 1-g | R.M. of Edwards Storage Dams: Antler Creek Dam..... Gainsborough Cr. Dam..... Gainsborough Cr. Dam..... Graham Creek Dam..... | Sec. 14-1-28-1..... Sec. 3-2-28-1 Sec. 3-2-29-1 Sec. 8-4-28-1 | Timber crib rockfill overflow weirs controlled by stop-logs for stockwatering purposes. Completed in 1935. | 100 | | 10,214.03 |

| 2 | LaSalle River Development... | | Development of LaSalle River for stockwatering and domestic supply. | | | |
|-----|------------------------------------|-----------------------|---|-------|-------|------------|
| 2-a | LaSalle River, Dam No. 1..... | River Lot 64..... | Reinforced concrete overflow dam controlled by stoplogs. Completed in 1941. | 900 | | 22,738.68 |
| 2-b | LaSalle River, Dam No. 2..... | Sec. 22-8-1, EPM..... | Reinforced concrete overflow dam controlled by stoplogs. Completed in 1941. | | | |
| 2-c | LaSalle River, Dam No. 3..... | Sec. 29-8-1, EPM..... | Reinforced concrete overflow dam controlled by stoplogs. Completed in 1941. | | | |
| | Miscellaneous Projects in Manitoba | | | | | |
| 3 | Whitemud River, Gladstone Dam. | Gladstone..... | Reinforced concrete dam controlled by stoplogs. Completed in 1943. | 660 | | 8,868.80 |
| 4 | Deadhorse Creek Dam..... | Morden..... | Earthfill dam controlled by reinforced concrete spillway chute. Completed in 1941. | 1,200 | | 47,705.85 |
| 5 | Brandon Dam..... | Brandon..... | Reinforced concrete dam on Assiniboine River built by Province of Manitoba with assistance of P.F.R.A. Completed in 1940. | 500 | | 3,996.45 |
| 6 | Clearwater Dam..... | Clearwater..... | Timber crib rockfill dam for stockwatering purposes. Completed in 1938. | 12 | | 5,948.70 |
| 7 | Carnan Dam..... | Carnan..... | Reinforced concrete dam on Morris River with stoplog control. Completed in 1940. | 600 | | 17,016.00 |
| 8 | Rock Lake Dam..... | Outlet of Rock Lake. | Reinforced concrete dam on outlet of Rock Lake with stoplog control. Completed in 1940. | 3 | | 3,334.21 |
| 9 | Crystal City Dam..... | Sec. 24-2-12, WPM. | Timber crib rockfill dam for stockwatering. Completed in 1935. | | | |
| | TOTAL—MANITOBA..... | | | 100 | 6,925 | 167,282.31 |

APPENDIX III—Continued

LARGE P.F.R.A. WATER DEVELOPMENT PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION IN
SASKATCHEWAN AS OF MARCH 31, 1943

| No. | Name of Project | Location | Description of Project | Irrigable Area (acres) | Storage Capacity (acre-ft.) | Construction Cost including Land Purchase |
|------|---|-----------------------------------|--|------------------------|-----------------------------|---|
| 10 | Frenchman River and Battle Creek Development. | | | | | \$ |
| 10-a | Cypress Lake Storage | Tp. 6, Rgs. 25, 26 and 27, W3. | Development of Frenchman River and Battle Creek consisting of reservoirs, supply and distribution canals for irrigation and other purposes. Estimated ultimate irrigable area over 20,000 acres. | 80,000 | 466,811.23 | |
| 10-b | Val Marie Irrigation District... | Tp. 4, Rge. 14, W3. | Storage dams and canals to conserve Battle Creek and Frenchman River waters for irrigation. | 6,000 | 214,142.19 | |
| 10-c | West Val Marie Irrigation District. | Sec. 12-5-15, W3.... | Secondary reservoir canals and distribution system for Val Marie flats. Completed in 1937. | 2,000 | 150,639.28 | |
| 10-d | Proposed Consul-Vidora Irrigation District. | Tps. 4 and 5, Rgs. 26 and 27, W3. | Secondary reservoir, pumping plant, canals and distributaries for river flats west of Val Marie. Completed in 1941 except for pump equipment. | 3,000 | (In cost of Cypress Lake). | |
| 10-e | Eastend Irrigation District.... | Sec. 25-6-22, W3.... | Irrigable lands commanded by canal four miles in length at west outlet of Cypress Lake. | 2,500 | 70,330.37 | |
| 10-f | Eastend Irrigation Extension.... | Tp. 6-21-W3..... | Storage dam and canals to irrigate land in Frenchman River valley at Eastend. Completed in 1937. | 2,896 | 90,471.28 | |
| 11 | Maple Creek Development.... | | Extension of Eastend Irrigation District canals. Completed in 1939. | | | |
| 11-a | Downie Lake Reservoir..... | Tp. 9, Rge. 23, W3. | Development of Maple, Gap and Downie Creeks for irrigation, stockwatering and domestic purposes. | 10,000 | 134,327.57 | |
| 11-b | Junction Reservoir..... | Sec. 5-12-26, W3.... | Earthfill dam, storage canals and other works to store water of Gap and Downie Creeks for irrigation. Completed in 1938. | 10,000 | 52,337.79 | |
| | | | Earthfill dam and concrete spillway chute to store water of Maple Creek for irrigation. Completed in 1939. | | | |

| | | | | | | |
|------|---|------------------------------|--|--------|--------|------------|
| 11-c | Tenaille Lake Storage | Sec. 20-13-26, W3... | Diversion canals, dykes and distribution to irrigate lands below Tenaille Lake. Completed in 1939. | 3,000 | 3,260 | 22,385.25 |
| 11-d | Maple Creek Flats Distribution Canals. | Near Town of Maple Creek | Laterals and land preparation | 3,000 | | 119,257.50 |
| 12 | Swift Current Creek Development | | Development of Swift Current and Rush Lake Creeks for irrigation, stockwatering, municipal and domestic water supply. | | | |
| 12-a | Duncairn Storage | Sec. 7-13-15, W3.... | Earthfill dam on Swift Current Creek controlled by concrete spillway chute with control gates. Completed in 1943. | 85,000 | | 186,859.65 |
| 12-b | Highfield Storage | Sec. 36-15-11, W3... | Earthfill dam to create secondary reservoir for irrigable lands below. Completed in 1943. | 10,000 | | 90,645.13 |
| 12-c | Pelletier Lake Storage | Sec. 24-12-15, W3.... | Earthfill dam at outlet of Pelletier Lake to create storage for irrigation and other purposes. | 3,350 | | 2,139.08 |
| 12-d | Swift Current Distribution System. | Tps. 15 and 16, Rge. 13, W3. | Canals and drainage ditches to provide irrigation facilities for 25,000 acres of land. Under construction. | 25,000 | | 16,737.98 |
| | Other Developments in the Cypress Hills | | | | | |
| 13 | Adams Lake Storage | Sec. 14-8-29, W3.... | Earthfill dam at outlet of Adams Lake. Completed in 1936. | 1,500 | 2,000 | 8,831.07 |
| 14 | Middle Creek Storage | Sec. 21-4-30, W3.... | Earthfill dam on Middle Creek. Completed in 1937..... | 1,000 | 20,000 | 18,661.27 |
| 15 | Souris River Estevan Irrigation Development. | | Development of Souris River and Roughbark Creek for irrigation, stockwatering and domestic purposes. | | | |
| 15-a | Roughbark Creek Storage | Sec. 29-6-13, W2.... | Earth fill dam to create storage on Roughbark Creek for irrigable lands. | 1,500 | | 9,314.93 |
| 15-b | Dead Lake Storage | Sec. 8-4-11, W2.... | Rockfill crib overflow weir on Souris River to conserve water in Dead Lake and Souris River for irrigation. Completed in 1937. | 2,600 | | 14,615.98 |
| 15-c | Souris River Estevan Flood Irrigation System. | Between Dead Lake & Estevan | Canals and dykes to flood flats. Completed in 1940.... | 3,900 | | 91,133.09 |
| 16 | City of Weyburn Water Supply | | | | | |

APPENDIX III—Continued

LARGE P.F.R.A. WATER DEVELOPMENT PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION IN
SASKATCHEWAN AS OF MARCH 31, 1943—Continued

| No. | Name of Project | Location | Description of Project | Irrigable Area (acres) | Storage Capacity (acre-ft.) | Construction Cost including Land Purchase |
|------|--------------------------------|----------------------|---|------------------------|-----------------------------|---|
| 16-a | Weyburn Storage..... | Near Weyburn..... | Earthfill dam to store water on Souris River for the City of Weyburn. | | 4,430 | \$ 39,411.13 |
| 16-b | Souris River Diversion..... | Near Weyburn..... | Diversion of Souris River to supplement underground water supply for the City of Weyburn. Completed in 1937-38. | 67 | | 6,603.45 |
| 17 | Kisbey Flats Flood Irrigation. | | Development of Moose Mountain Creek for irrigation, stockwatering, domestic and other purposes. | | | |
| 17-a | Moose Mountain Lake Storage. | Sec. 9-11-8, W2..... | Earthfill dam at outlet of Moose Mountain Lake to store water for Kisbey Flats. | 8,000 | | 14,828.85 |
| 17-b | Kisbey Flats Flood Irrigation. | Tp. 8-5-W2..... | Dykes and flood canals to distribute water on flats..... | 2,300 | | 23,211.40 |
| 18 | Long Creek Water Development. | | Development of Long Creek for stockwatering and domestic purposes. | | | |
| 18-a | Long Creek Dam No. 1..... | Sec. 10-2-8, W2..... | Rockfill timber dam for stockwater and domestic supply. | 137 | | 8,729.62 |
| 18-b | Long Creek Dam No. 2..... | Sec. 13-1-8, W2..... | Rockfill timber dam for stockwater and domestic supply. | 90 | | 8,701.46 |
| 19 | Oxbow Dam—Souris River.... | Sec. 14-3-2, W2..... | Rockfill timber crib stockwater dam. Completed in 1938. | 600 | | 17,436.15 |
| 20 | Qu'Appelle River Development | | Development of Qu'Appelle River and Moose Jaw Creek and other tributaries, for irrigation stockwatering and domestic purposes. Ultimate irrigable area, approximately 30,000 acres. | | | |
| 20-a | Buffalo Pound Lake Storage... | Sec. 31-18-24, W2... | Earthfill dam and concrete diversion weir to store water for irrigation. Completed in 1940. | 5,300 | 34,000 | 82,940.20 |

| | | | | | |
|------|--|-----------------------------|---|--------------|------------|
| 20-b | Last Mountain Lake Control... | Valeport..... | Earthfill concrete and timber gate to control lake..... | 1,000 | 27,279.26 |
| 20-c | Round Lake Storage..... | Sec. 14-18-3, W2.... | Reinforced concrete dam controlled by stop logs. Completed in 1941. | 14,700 | 40,244.36 |
| 20-d | Crooked Lake Storage..... | Sec. 8-19A-5, W2.... | Reinforced concrete dam controlled by stop logs. Completed in 1941. | 24,000 | |
| 20-e | Echo Lake Storage..... | Fort Qu'Appelle.... | Reinforced concrete dam controlled by stop logs. Completed in 1943. | 22,900 | 24,088.80 |
| 20-f | Lebret Lake Shore..... | Lebret..... | Riprap protection against erosion from wave action. Completed in 1940. | | 16,340.18 |
| 20-g | Fairy Hill Flood Control..... | Tp. 21-19-W2..... | Control works and drainage canal. Completed in 1941... | | 4,302.10 |
| 21 | Wood River Storage..... | Various..... | A series of timber crib rockfill dams for stockwatering purposes. Completed in 1941: | 4,923 | 33,738.02 |
| | Miscellaneous Projects in Saskatchewan | | | | |
| 22 | Arcola Water Supply..... | Sec. 26-8-4, W2.... | Improvements to water supply for Town of Arcola and district. Completed in 1939. | Under-ground | 17,310.00 |
| 23 | Battleford Mental Hospital Irrigation Project. | Tp. 43-16-W3..... | Timber crib rockfill weir to divert the Battle River..... | 800 | 3,057.75 |
| 24 | Village of Tantallon Water Supply. | Tantallon..... | Replacement of existing woodstave pipe. Completed in 1942. | | 2,790.00 |
| 25 | Big Arm Storage..... | Sec. 30-25-25, W2... | Storage on Arm of Last Mountain Lake for pump irrigation. Completed in 1939. | 5,000 | 13,060.66 |
| 26 | Caron Water Storage..... | Thunder Creek.... | Water supply primarily for the City of Moose Jaw by pumping plant, canal and saturation area. | 43,500 | 678,926.35 |
| 27 | Jackfish Creek Storage..... | Sec. 4-46-17, W3.... | Timber crib, rockfill dam on Jackfish Creek for stockwatering purposes. | 90 | 2,940.74 |
| 28 | Canora Storage..... | Canora..... | Reinforced concrete dam on Whitesand River for municipal and stockwatering purposes. | 300 | 15,616.77 |
| 29 | Lake of the Rivers Storage... | Sec. 4-8-29, W2..... | Earthfill dam on tributary to Lake of the Rivers for stockwatering purposes. Completed in 1938. | 300 | 10,805.14 |
| 30 | Moose Jaw Creek Flood Irrigation. | Tp. 10, Rgs. 17 and 18, W2. | Timber control works to flood lands for irrigation..... | 2,250 | 7,517.77 |

APPENDIX III—Continued

LARGE P.F.R.A. WATER DEVELOPMENT PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION IN
SASKATCHEWAN AS OF MARCH 31, 1943—Concluded

| No. | Name of Project | Location | Description of Project | Irrigable Area (acres) | Storage Capacity (acre-ft.) | Construction Cost including Land Purchase \$ |
|--------------------|-----------------------------|-----------------------|--|------------------------|-----------------------------|---|
| 31 | Pipestone Lake Storage..... | Sec. 6-15-3, W2..... | Earthfill dam at outlet of Pipestone Lake for stockwatering purposes. Completed in 1938. | | 1,600 | 10,808.44 |
| 32 | Saskatoon Dam..... | Sec. 34-36-5, W3..... | Concrete weir across South Saskatchewan River at Saskatoon to raise water level 11 feet at low stage. Completed in 1940. | | | 290,446.04 |
| 33 | Wascana Creek Reclamation.. | Near Lajord..... | Creek channel improvement to drain lands..... | | | 13,800.00 |
| 34 | Lafleche Storage..... | Lafleche..... | Earthfill dam to create water supply for Town of Lafleche and district. Completed in 1940. | 38 | | 2,525.48 |
| 35 | Girvin Dam..... | Sec. 21-25-28, W2.... | Earthfill dam to create stockwater supply. Completed in 1937. | 19 | | 2,180.13 |
| 36 | Davidson Dam..... | Sec. 27-26-29, W2.... | Earthfill dam to create stockwater supply. Completed in 1937. | 100 | 277 | 3,113.67 |
| 37 | Dunn & Watt Irrigation..... | Sec. 11-1-8, W3..... | Rock and earth diversion dam on McEachern Creek for irrigation purposes. Completed in 1937. | 305 | | 2,995.56 |
| 38 | Kenaston Dam..... | Sec. 32-29-28, W2.... | Earthfill dam to create stockwater supply. Completed in 1937. | | 350 | 1,896.28 |
| 39 | Masefield Storage..... | Sec. 16-2-14, W3.... | Earthfill dam to create stockwater supply. Completed in 1938. | | 40 | 3,187.23 |
| TOTAL—SASKATCHEWAN | | | | 47,316 | 404,751 | 3,190,533.63 |

APPENDIX III—Continued

LARGE P.F.R.A. WATER DEVELOPMENT PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION IN
ALBERTA AS OF MARCH 31, 1943

| No. | Name of Project | Location | Description of Project | Irrigable Area (acres) | Storage Capacity (acre-ft.) | Construction Cost including Land Purchase |
|------|--|--|--|------------------------|-----------------------------|---|
| 40 | Eastern Irrigation District Development. | | Improvement and extension of works of existing irrigation district, to irrigate additional lands. | | | \$ |
| 40-a | Cowoki Dam..... | Tp. 18-13-W4 | Earthfill dam across coulee to store water for irrigation. | 2,280 | 14,000 | 7,490.00 |
| 40-b | Sutherland Dam..... | Near Brooks..... | Earthfill dam across Lone Tree Creek to store waste water for irrigation. Built by Eastern Irrigation District at a cost of \$21,777.87 to which P.F.R.A. contributed \$15,000.00 Completed in 1936. | | 8,000 | 15,000.00 |
| 40-c | Rolling Hills Irrigation..... | Tps. 14 and 15, Rgs. 12 and 13 and 14, W4. | Extension of irrigation facilities from Eastern Irrigation District reservoir to some 25,000 acres. Completed in 1938. Under P.F.R.A. settlement. | 25,000 | Lake Newell | 46,838.78 |
| 41 | Canada Land and Irrigation Company, Repairs. | Vauxhall..... | Improvement and extension of works of existing irrigation district to irrigate additional lands. Completed in 1936. | Approx. 45,000 | | 80,000.00 |
| 42 | Leavitt Irrigation District..... | Tp. 2-28-W4..... | Storage at Driggs Lake and main supply canals to irrigate land east of Mountain View District. | 7,000 | 7,050 | 63,935.89 |
| 43 | Mountain View Irrigation District. | Tps. 2 and 3, Rgs. 27 and 28, W4. | Repairs to existing irrigation works. Completed in 1936. | 4,200 | | 2,497.78 |
| 44 | Magrath Irrigation District..... | Tp. 5-23-W4..... | Repairs to main canal existing in the Magrath Irrigation District. Completed in 1939. | 4,955 | | 2,755.58 |
| 45 | Atlee Gas Well..... | Sec. 10-23-7, W4.... | Exploratory boring to determine if natural gas is available in sufficient quantities to provide power for pump irrigation. | 7,000 | | 26,722.78 |
| 46 | Bartman Dam..... | Sec. 3-25-11, W4.... | Earthfill dam on East Berry Creek for stockwatering and irrigation. | 1,000 | 3,000 | 35,067.57 |

APPENDIX III—*Concluded*

LARGE P.F.R.A. WATER DEVELOPMENT PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION IN
ALBERTA AS OF MARCH 31, 1943—*Concluded*

| No. | Name of Project | Location | Description of Project | Irrigable Area (acres) | Storage Capacity (acre-ft.) | Construction Cost including Land Purchase |
|-----|---|----------------------|--|------------------------|-----------------------------|---|
| 47 | Bullshead Creek Storage..... | Sec. 28-8-4, W4..... | Earthfill dam on Bullshead Creek for stockwatering and irrigation. Completed in 1940. | 800 | 1,130 | \$ 8,170.45 |
| 48 | Wildhorse Dam..... | Sec. 23-2-3, W4..... | Earthfill dam on Elbow Coulee to store water from Sage Creek for irrigation and stockwatering. Completed in 1936; breached in 1937 and not yet repaired. | 3,600 | 4,500 | 24,369.78 |
| 49 | Seven Persons Creek Storage.. | Near Seven Persons | Earthfill dam on Seven Persons Creek to store water for stockwatering and irrigation. Completed in 1943. | 800 | | 5,142.06 |
| 50 | Graham Creek Storage..... | SW 30-26-27, W4.... | Earthfill dam at old flume crossing to conserve water for stockwater and domestic use. Completed in 1943 but not fully paid for. | | | 29.29 |
| 51 | Raymond Dam..... | Raymond..... | Earthfill dam to create reservoir for water supply and irrigation. Completed in 1942 but not paid for. | | | 20,576.92 |
| 52 | Test Borings..... | Various..... | Test drilling to determine foundation conditions for dams | 95,880 | 38,480 | 338,596.88 |
| | TOTAL—ALBERTA.. | | | | | |
| | TOTAL FOR MANITOBA, SASKATCHEWAN AND ALBERTA..... | | | 143,296 | 447,931 | 3,535,611.17 |





3 1761 11553112 1